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MANUAL OF DISEASES OF THE

# THROAT AND NOSE

THE SECOND VOLUME

*Of this work is in the press and will be published in a few months. It will include*

## DISEASES

OF THE

## ŒSOPHAGUS, NASAL CAVITIES, AND NECK.

The following is an abstract of the Contents:—

ŒSOPHAGUS.—Œsophagitis, Dilatation, Cancer, Non-Malignant Tumours, Nervous Dysphagia, Wounds, Foreign Bodies, Malformations, &c. &c.

NOSE.—Catarrh, Ozæna, Chronic Rhinitis, Epistaxis, Polypus, Adenoid Growths, Cancer, Syphilis, Nasal Calculi, Foreign Bodies in the Nasal Cavities, Malformations, &c. &c.

NECK.—Scrofula, Lymphoma, Sarcoma, Goitre, Exophthalmic Bronchocele, Cysts, Aneurisms, &c. &c.

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# A MANUAL OF DISEASES

OF THE

# THROAT AND NOSE,

INCLUDING THE

*PHARYNX, LARYNX, TRACHEA,*
*ŒSOPHAGUS, NASAL CAVITIES, AND NECK.*

BY

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OF VIENNA.

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*Vol. I.—Diseases of the Pharynx, Larynx, and Trachea.*

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# PREFACE.

THIS work is based partly on the courses of lectures which I have annually delivered at the London Hospital Medical College during the last twelve years, and partly on my essay on "Diseases of the Larynx," to which the Jacksonian Prize was awarded by the Royal College of Surgeons of England. Some of my lectures have appeared in the *British Medical Journal*, *Lancet*, and *Medical Times and Gazette*, but by far the larger portion of the matter contained in these pages is now published for the first time.

The classification of disease is always attended with considerable difficulty, and at present no single system can be rigidly adhered to. For even accepting pathology as the basis, the tissues themselves are of so composite a character, and there are so many "organs within organs" in the human frame, that logical precision cannot be maintained, except by pedantic subdivisions, which would defeat the object of the arrangement. Again, whilst some throat affections are strictly circumscribed in their ravages, others attack different sections of the air-passages at the same time. Hence, although this work has been divided into certain primary sections, and as a rule each disease has been

separately considered in its proper division; yet in some cases it has been found more convenient to depart from this plan, and to treat the morbid phenomena of contiguous parts together.

The system of nomenclature issued by the Royal College of Physicians has been adopted, with such modifications and additions as the consideration of a special class of diseases rendered necessary.

Records of cases have, as a rule, only been introduced where they were required for the illustration of a difficult subject, or where the cases themselves were exceptionally rare.

The views which I entertain as regards the use of mercury in syphilis will probably meet with some opposition, but having followed Professor Sigmund's practice in Vienna in 1859 and 1860, I became well acquainted with his views at an early period of my medical career, and a somewhat extensive experience in dealing with the constitutional phenomena of syphilis has since convinced me of the truth of the fundamental views entertained by the eminent Viennese Professor, viz.:—(1) That specific anti-syphilitic treatment is only required when serious constitutional symptoms are present; (2) that specific treatment in the early stages does not ward off the later manifestations of the affection; (3) that local treatment, analeptic remedies, and hygienic measures are of the utmost importance; (4) that the disease itself, except under unfavourable circumstances, tends towards spontaneous cure; and (5) that the development of serious pathological changes depends on conditions inherent in the patient himself. These views have been sustained by Professor Sigmund with all his old energy in the recent edition of his well-known "Vorlesungen über neuere Behandlungsweisen der

Syphilis." It will, I hope, be understood that whilst employing iodide of potassium more frequently, I nevertheless consider mercury a valuable, and in some cases an indispensable, remedy in syphilis.

Whilst placing the results of my own experience before the profession, I have endeavoured to do full justice to the many physicians, both ancient and modern, who have elucidated the class of affections herein discussed; and if, in any case, I have failed to acknowledge the labours of others, I trust that the error may be looked upon as accidental.

I am indebted to many distinguished authors for kindly forwarding me their valuable works and new editions, and I much regret that I was only able to make use of some of them for a few casual references, in consequence of their not having reached me until the greater part of this volume was already in type. This remark especially applies to the second edition of Dr. Solis Cohen's excellent work on "Diseases of the Throat and Nasal Passages," and to the second (German) edition of Prof. Ziemssen's able contribution on the "Krankheiten des Kehlkopfes" to his own Encyclopædia; it applies also to Dr. Max Schüller's exhaustive article in the "Deutsche Chirurgie," entitled "Tracheotomie, Laryngotomie, und Exstirpation des Kehlkopfes," and to Prof. Stoerk's comprehensive treatise in the same series on the "Krankheiten des Kehlkopfes, der Nase, und des Rachens." For the reason stated above I have also been obliged to forego the satisfaction of even referring to many other smaller works, to which I hope to do justice on a future occasion.

Incomplete as the work is in many respects, yet, owing to my numerous professional engagements, I could not have collected the materials on which it is

founded had it not been for the assistance I have received from many friends. It would be difficult to assign to each the due amount of my obligations, and I must therefore content myself by thanking them collectively. There are a few, however, whose names cannot be altogether omitted. Thus I am especially indebted to my colleague, Dr. Semon, who has prepared a German translation of this work (to appear simultaneously with the English edition), for many important suggestions and much keen criticism; I have to thank my former assistant, Dr. Gordon Holmes, for valuable aid in matters of historical research, more particularly in connection with those authors whose observations are recorded in the classical languages; and I am very grateful to Mr. Mark Hovell, Resident Medical Officer and Registrar to the Hospital for Diseases of the Throat and Chest, for preparing a detailed index.

M. M.

19, Harley Street, London,
*May*, 1880.

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## CORRIGENDA AND ADDENDA.

Page 13, line 15 from bottom, *for* "Metzler" *read* "Meltzer."

,, 90, line 6 from top, *for* "Lanceraux" *read* "Lancereaux."

,, 269, line 17 from top, *add* the figure "2" after Ziemssen.

,, 279, line 7 from bottom, *for* "Sanné" *read* "Sestier."

,, 292, foot-note, *for* "Traitè de Pathologie interne," vol. i. *read* "Virchow's Handbuch der speciellen Pathologie und Therapie." Abtheilung: "Krankheiten des Larynx und der Trachea," p. 492.

,, 293, foot-note 1, *for* "Traité de Pathologie," &c, *read* "Ziemssen's Cyclopædia" (Engl. Edit.), vol. iv. p. 217.

,, 295, line 15 from top, *for* "nine" *read* "seven."

,, 298, the second part of foot-note 8 refers to Gurdon Buck on page 299.

,, 300, to the last foot-note, *prefix* figure "9."

,, 347, case No. 14, column 7, after the word "with," *add* "exception of."

,, 376, *omit* the word "and" at the end of line 22.

,, 378, *transfer* foot-note 1 to page 381, and *prefix* the figure "2" to it in place of "1," *adding* also a figure "2" after Fränkel, line 5 from bottom.

,, 380, line 3 from bottom, after phthisis, *add* "in which there was laryngeal ulceration."

,, 381, see above, page 378.

,, 391, line 10 from top, *for* "5 times" *read* "4 times."

,, 392, line 18 from top, *omit* the words "traumatic cases."

,, 427, line 28 from bottom, *for* "left" *read* "right."

,, 429, line 18 from bottom, *for* "fifteen" *read* "five."

,, 431, line 14 from bottom, *for* "1862" *read* "1864."

,, 439, in place of foot-note 3, *read* "Deutsches Archiv f. klin. Medicin, 1867, ii. S. 550."

,, 465, line 13 from top, *for* "tonic" *read* "toxic."

,, 468, line 8 from bottom, *for* "Olliver" *read* "Oliver."

,, 481, line 5 from bottom, *for* "Miller" *read* "Millar."

,, 486, line 13 from bottom, *for* "Steiner" *read* "Steffen."

,, 495, line 15 from top, omit "Previously," and in next line, *for* "had" *read* "has."

A MANUAL OF

# DISEASES OF THE THROAT AND NOSE.

## SECTION I.—THE PHARYNX.

### ANATOMY OF THE PHARYNX.

The pharynx is that portion of the alimentary tube which corresponds in extent to the interval between the basilar process of the occipital bone above and the interval between the fourth and fifth cervical vertebræ below. It is continuous below with the œsophagus and larynx, in front with the nasal and oral cavities, and above with the ear. It may be described as an irregularly flattened cylinder, wider above than below, and slightly concave anteriorly, applied to the anterior surface of the vertebræ. Its roof, which lies immediately below the skull, is quadrilateral, with rounded edges. It is concave in an antero-posterior direction, directly continuous with its posterior wall, and in form, may not inaptly be compared to the hood of a carriage. The pharynx is freely moveable over the cervical spine, and thus permits the various movements which take place in swallowing and respiration. It is in relation with the following structures: posteriorly, with the pre-vertebral muscles, which are covered by a strong aponeurosis, and from which it is separated by the retro-pharyngeal cellular tissue; laterally, with the carotids, the internal jugular veins, the eighth pair of nerves, the sympathetic nerve, and a chain of lymphatics and ganglia; anteriorly, with the nasal fossæ, soft palate, isthmus of the fauces, dorsum of tongue, and posterior aspect of the larynx. The maximum length of the pharynx in the adult is about five inches, and its superior transverse diameter about one inch and three-fifths. It is slightly wider opposite the cornua of the hyoid bone, and opposite the cricoid cartilage it again becomes contracted. Its diameter, in an antero-posterior direction, is about four-fifths of an inch superiorly. Below, its anterior and posterior surfaces are in contact in the centre. Its osseous relations are: superiorly, the basilar portion of the occipital, and the body of the sphenoid, bone, and the so-called basilar fibro-cartilage; anteriorly and above, the vomer in the mesial line; laterally, the internal pterygoid plates of the sphenoid bone; below, the horizontal plates of the palate bone; and posteriorly, the anterior surface of the five upper cervical vertebræ, with their fibro-cartilages.

The pharynx consists essentially of a fibrous frame-work, lined by mucous membrane, and containing a complex muscular layer, with blood-vessels and nerves. These elements will be described in the order they are met with in actual examination, a general idea of the inner aspect of the cavity being first given.

For convenience of description, the pharynx may be regarded as consisting of a pharyngo-nasal, a pharyngo-oral, and a pharyngo-laryngeal cavity. The former is concerned in respiration and in the modification of the tone of the voice; the second and third, in both respiration and deglutition.

The pharyngo-nasal space is continuous anteriorly with the nasal cavities, and laterally communicates by means of the Eustachian tube with the middle ear. The upper wall or roof, already described, is rich in gland tissue, and shows numerous depressions and crypts. In some subjects there is a cavity of considerable depth situated posteriorly and in the centre of the roof, in which are found the openings of numerous follicles. This collection of follicles has been described by Luschka[1] as an aggregated acinous gland, and named the "pharyngeal tonsil," in contradistinction to the analogous glands in the fauces. This tonsil is about a centimetre in thickness, and is situated near the vault of the pharynx, between the orifices of the two Eustachian tubes. It is covered with the ciliated epithelium found in this portion of the cavity. The gland is composed of follicles more or less compactly united, and its surface is dotted by a number of small prominences—the openings of the glandulæ. The pharyngeal tonsil is not enclosed within a proper capsule, the reticular connective tissue of the gland being continuous with that of the adjacent mucous membrane. According to Tortual[2] there is a deepish sinus at the anterior border of the roof, which he calls the sinus faucium superior; it extends forwards from the semilunar fold of mucous membrane at the border of the posterior nares, externally and below the upper edge of the orifice of the Eustachian tube. The lateral walls of this cavity are limited superiorly by the openings of the Eustachian tubes and the recessus pharyngeus, or fossa of Rosenmüller. The opening of the cartilaginous portion of the Eustachian tube lies on the level of the posterior nares, and is about one-fifth of an inch below the base of the skull, and about three inches and one-fifth from the anterior nares. The aperture is about two-fifths of an inch in its vertical, and about one-fifth in its transverse, diameter. That portion of it which appears in the pharynx is covered by mucous membrane, and is seen as a somewhat rounded elevation, with its convexity turned upwards and backwards; from its upper extremity a fold of mucous membrane extends to the border of the posterior nares, and from its posterior extremity another fold extends to the hinder surface of the velum pendulum palati. Between the orifice of the Eustachian tube and the posterior wall of the pharynx is a somewhat triangular shaped depression, covered with numerous glands, which is known as Rosenmüller's fossa. The posterior wall of this portion of the pharynx is almost vertical, and lies in front of the pharyngeal fascia, the anterior arch of the atlas, and the body of the axis. Its mucous surface is smooth, and shows the openings of numerous acini. The anterior wall presents the

[1] "Der Schlundkopf des Menschen." Tübingen, 1868, p. 110.
[2] Luschka: Op. cit. p. 18.

choanæ, separated by the septum narium, and below them the posterior surface of the soft palate (vide p. 5).

The pharyngo-oral cavity may be said to be limited superiorly by the level of the base of the uvula, and below by a plane passing through the posterior extremities of the greater cornua of the hyoid bone. The posterior surface of the uvula must be regarded as its incomplete anterior wall, the pillars of the fauces its lateral walls, and the base of the tongue, together with the folds of mucous membrane enclosing some muscular tissue, and known as the pharyngo-epiglottic folds, its lower margin.

The pharyngo-laryngeal cavity occupies the position corresponding with the hyoid bone above and the inferior border of the cricoid cartilage below. On its anterior surface, running obliquely downwards and slightly forwards, is the upper portion of the glosso-epiglottic fold on each side; in the middle, is the epiglottis; whilst the lower border of the cricoid cartilage may be regarded as its inferior limit. The posterior wall of this portion of the pharynx is channelled out, and not flat as in the upper regions. Its anterior wall is wanting centrally, owing to the opening of the larynx. Laterally, the anterior wall of this portion of the pharynx presents a fossa on each side, the pharyngo-laryngeal sinus, which is about half an inch in its antero-posterior diameter and somewhat broader laterally.

The pharyngeal walls average about one-tenth of an inch in thickness, and are formed of mucous membrane and glands, muscles, fibrous tissue, blood-vessels, lymphatics, and nerves.

The mucous membrane is applied to the entire internal surface of the pharynx, and is continuous with all the openings into it; it is slightly adherent to the underlying tissues in the upper portion, but below, in the laryngeal region, it becomes very lax. The structure of the mucous membrane is partly fibrous tissue and partly connective, varying with its position, in the greater part of the pharyngo-nasal cavity. Lower down it is denser than above, and contains an abundance of glandulæ. The epithelium in the pharyngo-nasal cavity, the surface of which is of a pale rose colour, is cylindrical and ciliated, whilst in the pharyngo-oral region and below it is tesselated, and somewhat redder.

The glands are of two kinds, conglomerate and follicular. In the pharyngo-nasal cavity the former are most abundant, particularly at the posterior border of the Eustachian tubes and on the pharyngeal surface of the velum pendulum palati, where they are clustered together. They are more sparsely distributed lower down. The follicular glands are found in the pharyngo-oral cavity, and in the roof of the pharyngo-nasal cavity they are collected together and form "Luschka's tonsil"—already described.

The fibrous structure of the pharynx forms a complete investment, and serves to maintain its form. It is very tough and strong, and has the fibres of the several muscles attached to it. It is attached superiorly and centrally to the basilar process of the occipital bone through the intervention of the cranio-pharyngeal ligament, and laterally to the petrous portions of the temporal bones, hanging suspended as it were from these points. Its internal surface is covered by the pharyngeal mucous membrane, whilst its external surface supports the muscles of the pharynx. Below it becomes continuous with the cellular tissue of the œsophagus. Laterally, it is attached to the posterior border of the internal pterygoid plate of the sphenoid bone,

to the pterygo-maxillary ligament, the posterior portion of the mylo-hyoid ridge, the stylo-hyoid ligament, the cornua of the hyoid bone, the thyro-hyoid membrane, and the posterior border of the thyroid, and the external surface of the cricoid, cartilage.

The muscles of the pharynx consist of the three pairs of constrictors: the superior, middle, and inferior, which are arranged in layers, and the stylo-pharyngei.

The superior constrictors are flat quadrilateral muscles, the fibres of which are parallel to each other and directed horizontally. Their fixed insertion is to the lower portion of the internal pterygoid plate, the aponeurosis of the soft palate, the pterygo-maxillary ligament, the posterior portion of the mylo-hyoid ridge, and slightly to the side of the tongue. Their moveable attachment is to the median raphé, where some of the fibres of the muscles interlace. The muscular fibres from the internal pterygoid plate pass obliquely upwards to the median raphé at the base of the skull, forming a kind of festoon on either side of the middle line; the interspace is filled in by the pharyngeal aponeurosis and the mucous membrane (sinus of Morgagni). The middle constrictors lie in a plane posterior to the superior constrictors, their fixed attachments being to the greater and lesser cornua of the hyoid bone; from these the fibres pass backwards in the shape of a fan, the superior ones passing upwards and inwards and covering the superior constrictor, the middle passing transversely, and the inferior downwards and inwards. They are ultimately partly inserted in the median raphé, and partly into the pharyngeal aponeurosis—interlacing with each other. The inferior constrictors lie in a plane posterior to the middle, and have as their fixed attachments, anteriorly, the posterior border of the thyroid cartilage and the triangular surface on its outer wall, and the sides of the cricoid cartilage; from these points the fibres pass backwards, the inferior, horizontally, and the superior, upwards and inwards. In the middle line the fibres are inserted into the pharyngeal aponeurosis, interlacing with one another, and with the inferior fibres of the middle constrictor. The stylo-pharyngei are long delicate muscles arising from the bases of the styloid processes, and passing downwards, forwards, and inwards; the fibres expand and become inserted into the posterior border of the thyroid cartilage. At first this muscle is applied to the outer surfaces of the superior constrictor, but passing between the inner surface of the middle constrictor and the pharyngeal aponeurosis, it spreads out before it is inserted. These muscles are covered on their outer surfaces by the external fascia, which in the lower two-thirds of the pharynx is derived from the deep cervical, and at the upper third from the bucco-pharyngeal, fascia; whilst internally the fascia applied to them is the cephalo-pharyngeal, which is attached to the fibro-cartilage at the base of the skull.

The arteries are: the ascending pharyngeal from the external carotid, which supplies the chief portion of the region and the Eustachian tube; and anteriorly and laterally, behind and above the openings of the choanæ, some terminal twigs of the internal maxillary, the vidian, and spheno-palatine, which inosculate freely with each other. The veins are collected into a dense plexus in the deeper layers, and terminate in the internal jugular. The lymphatics form a network in the mucous membrane, and also in the muscular structures, and terminate in glands situated at the base of the skull and near the greater cornua of the hyoid bone. (Luschka.)

The nerves are derived from the second division of the fifth, which supplies the roof and orifice of the Eustachian tube, and from some twigs of the third division, which, however, more particularly pass to the soft palate. The glosso-pharyngeal nerve supplies the stylo-pharyngeus, the superior and middle constrictors, and the mucous membrane. The pharyngeal branches of the vagus, and glosso-pharyngeus, and the spinal accessory, communicate and supply the upper and middle constrictors and the mucous membrane (Hyrtl and Rüdinger), whilst the superior laryngeal supplies the superior constrictor. The sympathetic nerves are derived from the superior cervical and middle cervical ganglia.

## THE SOFT PALATE.

The soft palate is a moveable curtain continued backwards from the hard palate. It has two surfaces of mucous membrane, a posterior, continuous with that of the nasal cavity, and an anterior, continuous with the lining membrane of the mouth. Between these mucous surfaces is a stratum of muscular tissue. The soft palate (or velum pendulum palati) has the uvula in the centre, and laterally the pillars of the fauces, enclosing the tonsil. Its direction is obliquely backwards and downwards, as regards the hard palate. It is variable in thickness, averaging from one-fifth of an inch to about half an inch; its depth varies from an inch to an inch and a-half, and from its crescentic shape it is deeper in the centre than at the sides. Between the pillars of the fauces laterally, the margin of the velum above, and the root of the tongue below, is an opening, capable of many and varied movements—the isthmus of the fauces.

The anterior surface of the soft palate, which forms a portion of the mouth, presents on each side a sharp-edged free margin, springing from the base of the uvula, and curving downwards to the tongue, constituting the anterior pillar of the fauces. The mucous membrane on this anterior aspect has a smooth surface, and contains a stratum of acini closely packed together and continuous with those of the hard palate. In its mesial line is a vertical raphé—the indication of the fusion of the sides during embryonic life. Its posterior surface constitutes a portion of the anterior wall of the pharynx, and is formed also by two sickle-shaped processes or folds, whose margins diverge from the uvula as on the anterior surface, but they are thicker and their edges more rounded. Their upper extremities commence at the base of the uvula, and forming smaller arches than those on the anterior surface, pass backwards and downwards, becoming flatter as they descend, and losing themselves in the lateral walls of the pharynx. The mucous membrane is thickly studded with glands, which form a continuous layer (solitary follicles). The epithelium is of the squamous variety, excepting near the orifices of the Eustachian tubes, where it is ciliated.

The uvula hangs from the centre of the soft palate, as a conical process about a quarter of an inch in length, having the two crescentic folds of the margin of the velum on either side. It is composed of mucous membrane very rich in glands, and contains the azygos uvulæ muscles.

The tonsils lie between the pillars of the fauces, in a sort of niche, bounded internally by the base of the tongue. They are oval glandular masses, generally about as large as a hazel nut. They are follicular in structure, and, when of normal size, can be just seen

when the mouth is wide open, projecting into the isthmus faucium. On the internal surface are a number of mucous crypts, which open by from twelve to sixteen ducts, of varying size, and give the surface of the tonsils the appearance of almond nuts. In the spaces between the crypts, and enclosed in the connective tissue, are a quantity of lymphatic glandulæ. The tonsil is in relation externally with the internal pterygoid muscle, and corresponds with the angle of the jaw, or more accurately, the centre of the tonsil corresponds with the posterior alveolar foramen. Posteriorly, are the internal and external carotid arteries, the first about half an inch, and the latter about four-fifths of an inch, from the free surface of the gland, with the internal jugular vein, the vagus and glosso-pharyngeal nerves.

The muscles of the soft palate run in pairs, and under normal conditions act in concert.

The levator palati arises from the apex of the petrous portion of the temporal bone and the inferior cartilaginous portion of the Eustachian tube; the fibres pass downwards and inwards to be inserted into the superior surface of the velum, interlacing at the middle line. These muscles elevate the soft palate and contract the orifice of the Eustachian tube. The tensor palati arises from the scaphoid fossa and partly from the Eustachian tube. Its fibres pass vertically downwards to the hamular process, where the muscle becomes tendinous, and is reflected at a right angle; it is separated from the process by a small bursa. The tendinous fibres expand, and passing transversely inwards interlace with the opposite muscle, and become inserted into the inferior surface of the velum. These muscles stretch the soft palate, and during swallowing open the Eustachian tube and admit air to the tympanum. The azygos uvulæ (so called from having formerly been supposed to be a single muscle) arises from the posterior nasal spine and from the posterior portion of the mucous membrane which encloses the uvula; its office is to contract the uvula and draw it backwards. The palato-glossus forms the mass of the anterior pillar of the fauces; it is attached superiorly to the aponeurosis of the velum, and below is inserted into the tongue. It is a constrictor of the isthmus. The palato-pharyngeus forms the posterior pillar of the fauces, and arising in the soft palate by fibres connected with those of the opposite side, passes partly above and partly below the levator palati and azygos muscles. After forming the posterior pillar of the fauces the more internal fibres go to the mesial line, and are inserted into the pharyngeal aponeurosis, the middle become lost in the aponeurosis of the velum, and the external pass forwards and are inserted into the posterior border of the thyroid cartilage. These muscles contract the isthmus, and, acting with the levatores palati, keep the soft palate horizontal.

The arteries are derived from branches of the external carotid, viz.: the facial, the internal maxillary, and ascending pharyngeal. The pterygo-palatine twig of the internal maxillary and the ascending palatine branch of the facial artery supply the velum, though the latter is more particularly distributed to the mucous membrane, muscles, and glands, the aperture of the Eustachian tube, and its neighbourhood. The tonsillar branch of the facial artery supplies the tonsil, the sides of the pharynx, and the root of the tongue. The veins form two plexuses: the posterior, which is associated with the venous system of the nasal mucous membrane; and the anterior, associated with the tongue, and passing into the internal jugular by

means of the pharyngeal vein. The lymphatics are arranged, as the veins, in two plexuses, corresponding with those of the nose and root of the tongue; they pass into glands situated at the bifurcation of the common carotid, and in the region of the greater cornu of the hyoid bone.

The motor nerves of the soft palate are: the motor portion of the lower division of the fifth which supplies the tensor palati through the Otic ganglion; the facial supplying the levator palati and azygos uvulæ through the connection of its trunk with the Vidian by the petrosal nerves, and the palatine branches of Meckel's ganglion which supply the palato-glossus and palato-pharyngeus. The sensory nerves are derived from the second division of the fifth (its nasal ganglion), which supplies the anterior surface of the velum. The glosso-pharyngeal, vagus, and spinal accessory furnish twigs to the lateral and posterior portions of the soft palate and the tonsil. The chorda tympani presides over the secretory functions.

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## THE EXAMINATION OF THE PHARYNX.

The pharynx is not entirely accessible to direct vision, and the laryngoscope or pharyngoscope (as the instrument has been called when employed to examine the upper part of the throat) is requisite for the inspection of certain parts. Further, from the situation and conformation of the pharynx, some regions can only be investigated by means of probes or by digital exploration.

In making an ordinary examination, it is best to use the large frontal mirror of the laryngoscope. The patient should be directed to open his mouth and take a deep inspiration. The tongue should then be gently pressed down with a spatula, or, better still, with the handle of a laryngeal mirror. Sometimes, however, this organ is so unruly, and the patient so sensitive, that the slightest pressure will produce retching. Under these circumstances a view can often be obtained, without touching the tongue, when the patient inspires deeply; or the tongue may be protruded, and firmly but gently grasped between the thumb and index finger of the operator, enveloped in a towel or napkin. If the patient at the end of deep inspiration then utters the vowel "*a*," the soft palate and uvula, as well as the pillars of the fauces, will come into view.

The first object which attracts attention is the uvula, which in health is about a quarter of an inch in length, and of a pale red colour, like the palpebral conjunctiva. From the margin of the uvula on either side at its base,

presenting a crescentic border directed downwards, is the free border of the velum, or curtain, of the palate. This free border, when it reaches the side of the pharynx, becomes continuous with the posterior pillar of the fauces. About three-eighths of an inch above the base of the uvula on either side is the inner termination of a second crescentic ridge, which, passing outwards, forwards, and downwards, becomes continuous, at the side of the pharynx, with the anterior pillar of the fauces. Bounded by these pillars or ligaments, anteriorly and posteriorly on each side, are the tonsils, which in health do not project beyond the borders of the pillars. Between the two posterior pillars is the posterior wall of the pharynx, which, in common with all the other parts of this cavity, is lined with mucous membrane. It is a frequent seat of disease, and always deserves a close inspection. In health it is of a deeper red colour than the uvula; its surface is smooth and shining, and studded here and there with the minute elevations of the mucous follicles. Small veins and arteries are also seen coursing along its surface—generally taking a vertical, or obliquely vertical, direction.

The inferior portion of the pharynx is situated immediately behind, and partly below, the entrance of the larynx, and it sometimes happens that foreign bodies become impacted in this situation. They still more often become lodged in the pharyngo-laryngeal sinus, a small cavity at the lower part of the pharynx, on each side, bounded externally by the side of the pharynx, and internally by the thyroid cartilage. In some cases the cavity can be inspected with the laryngoscope, but in others it is concealed. Under these circumstances, in young subjects, or in persons with a short neck, the finger can often determine the exact position, and frequently effect the removal of a foreign body. In other cases, probes and forceps have to be employed.

For examining the upper part of the pharynx, a small laryngeal mirror should be used. In this situation, digital examination is, however, also very useful. The mouth being widely opened, the operator can pass his index finger upwards behind the soft palate, and the vault of the pharynx and its posterior wall in the upper region, as well as the orifices of the posterior nares and Eustachian tubes, can be thoroughly explored.

## PHARYNGEAL INSTRUMENTS.

*Probes.*—Special probes are not required for the pharynx, those used for the larynx (hereinafter described) answering the purpose perfectly well.

*Brushes.*—For applying solutions to that part of the pharynx which is visible on direct inspection, a camel's-hair pencil attached to a straight piece of aluminium wire, and fixed in a wooden handle, is all that is required. For applying remedies to the upper and lower part of the pharynx, the ordinary laryngeal brushes (see Laryngeal Instruments) answer every purpose.

*The Spatula*—This instrument (Fig. 1) resembles a long tapering wooden penholder, cut flat at both ends, so as to present a larger and smaller surface for receiving the caustic paste. It should be made of oak, box, or some other hard, wood. It is very useful for applying caustic paste in cases of granular pharynx.

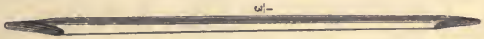

FIG. 1.—THE PHARYNGEAL SPATULA.

FIG. 2.—THE PHARYNGEAL BISTOURY.

*The Bistoury.*—This knife (Fig. 2) is like an ordinary sharp-pointed bistoury, except that the shank of the instrument should be about five and a-half inches long, and only the last quarter of an inch should have a cutting edge. This is the most serviceable instrument for opening abscesses.

*Forceps and Scissors.*—For removing growths from the pharynx, forceps and scissors are sometimes required. These instruments should be about eight inches in length. The forceps should have sharp teeth, and the scissors should be slightly curved.

*The Pharyngeal Curette.*—This instrument (Fig. 3) consists of a sharp loop of metal (somewhat resembling a curry-comb when its two ends are held in the hand), which can be fixed at any angle to its shaft, by means of a ball-joint and lock. It is extremely useful for scraping away the inspissated secretion in cases of follicular disease, especially when the affection occurs at the lower part of the pharynx, or

attacks the epiglottis. It may also be used for tearing away adenoid vegetations from the vault of the pharynx.

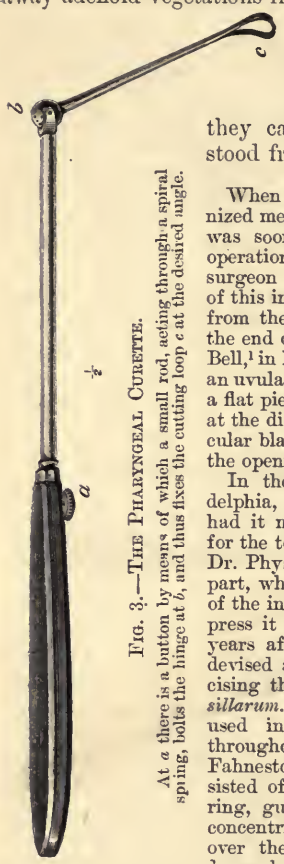


Fig. 3.—The Pharyngeal Curette.

At *a* there is a button by means of which a small rod, acting through a spiral spring, bolts the hinge at *b*, and thus fixes the cutting loop *c* at the desired angle.

*The Tonsillotome.*—Instruments for removing the enlarged tonsil are now very frequently employed, and the manner in which they came into use will be best understood from a short historical retrospect.

When excision of the tonsils became a recognized method of treatment the aid of mechanics was soon called in to effect an easy and rapid operation. We are indebted to an American surgeon for the first tonsillotome. The idea of this instrument appears to have been derived from the uvulatomes in use in this country at the end of the eighteenth century. Benjamin Bell,[1] in his classical work, described and figured an uvula guillotine. It consisted essentially of a flat piece of metal with an elliptical opening at the distal extremity, and a broad semi-circular blade, which when pushed forward closed the opening and cut off the uvula.

In the year 1827 Dr. Physick,[2] of Philadelphia, not only improved the uvulatome, but had it made on an enlarged scale, and used it for the tonsils. In modifying the instrument Dr. Physick added the stout handle at its lower part, which greatly facilitated the application of the instrument, and enabled the operator to press it firmly to the side of the throat. Five years after Physick's invention Fahnestock[3] devised and described an instrument for excising the tonsils, which he called a *sector tonsillarum*. This instrument has been largely used in France and Germany, and indeed throughout the whole world it is known as Fahnestock's guillotine. Originally it consisted of a canula terminating in a circular ring, guarding a blade of similar shape, with concentric cutting edge. On being placed over the tonsil the cutting ring was withdrawn by means of a handle attached to the canula, and the gland was divided from behind forwards. As soon as the instrument became the property of the surgical world it

[1] "System of Surgery." 1783, vol. iv. (p. 144, Plate lii. Fig. 1. Bell himself preferred a probe-pointed bistoury curved at the end almost to a semi-circle (same page and plate). Whatever instrument was used the uvula was steadily held, and the mouth kept open by a speculum oris or mouth dilator (Plate liv.)

[2] "Amer. J. Med. Sci," vol. i. p. 242. Messrs. Tiemann & Co., of New York, state that they manufactured a tonsillotome about the year 1828 or 1829, and, according to a letter lately placed in my hands by Dr. Beverley Robinson of New York, claim to have been the inventors of that instrument.

[3] "Amer. J. Med. Sci.," 1832, vol. xi. p. 248. Description of an instrument, &c. &c., by Wm. B. Fahnestock, M.D., of Lancaster, Philadelphia.

underwent numerous modifications. Guersant[1] altered the shape of the ring from circular to elliptical—a form which is much better adapted to the contour of the tonsil. The same surgeon, on the suggestion of Velpeau, added a small two-pronged fork to the tonsillotome by a mechanism which transfixed and drew the tonsil

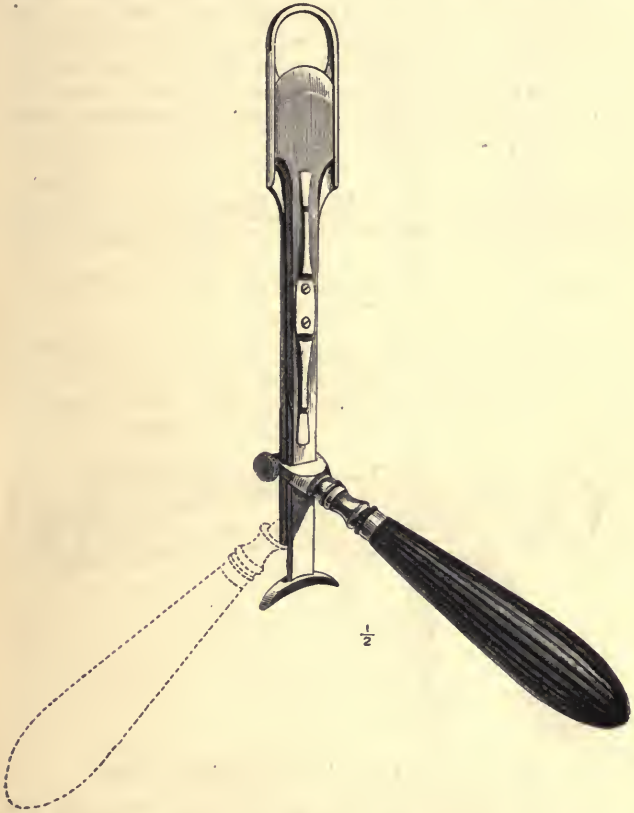

FIG. 4.—PHYSICK'S TONSILLOTOME. (Modified by the Author.)

from its bed before subjecting it to the action of the cutting blade. Chassaignac[2] augmented the number of prongs to three, in order that the gland might be seized with greater firmness, and Maisonneuve[3] made further improvements in the instrument.

[1] "Hypertrophie des Amygdales." Paris, 1864.
[2] "Leçons sur l'Hypertrophie des Amygdales." Paris, 1854.
[3] "Bull. de la Soc. de Chir."

Though Fahnestock's guillotine is almost universally used, I greatly prefer instruments made on the simple model of Physick, as all complicated mechanism is thereby avoided, the instrument never breaks, and can always be kept clean and sharp. With Physick's instrument also the operator has much more power in placing the tonsillotome *in situ*. The guillotine which I employ is the same as that of Physick slightly modified—so that the handle can be applied to either side of the shank. This arrangement enables the operator to use the instrument with his right hand for amputating either tonsil, the free surface of the blade in each case being directed

FIG. 5.—FAHNESTOCK'S TONSILLOTOME (as improved by French surgeons).

towards the centre of the mouth. In operating the patient should sit facing the light, and the operator with his back to it. A laryngoscopist, however, will always prefer to illuminate the throat with the frontal mirror. The in-

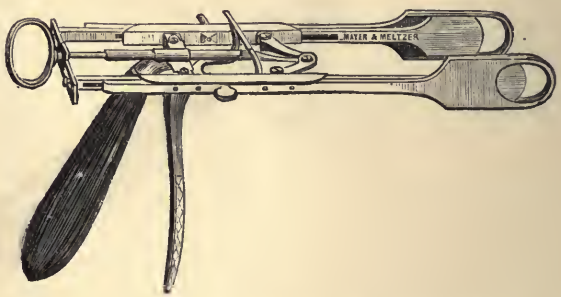


FIG. 6.—THE AUTHOR'S DOUBLE TONSILLOTOME.

When the instrument is introduced into the mouth the blades meet in the centre; but on grasping the two handles together, the blades are thrown out against the sides of the throat, and the tonsils received in the oval openings of the tonsillotomes. Amputation is then effected by pressing on the ring at the proximal extremity of the instrument in the ordinary way.

strument being ready for use, the hilt is grasped in the right hand, and the aperture in the shank is placed over the tonsil. The surgeon, with the thumb or index finger of the left hand placed under the angle of the

patient's jaw, then presses the tonsil inwards, whilst at the same moment, with the thumb of his right hand, he drives home the blade of the tonsillotome.

Professor Lucae,[1] of Berlin, has still further modified this instrument by adding a cup-shaped cavity over the extremity — in order to prevent the excised tonsil falling down the throat —and by dispensing with the wooden handle. As, however, in using Physick's guillotine the tonsil is always either caught in the instrument or brought forward into the mouth, I do not see the use of Professor Lucae's suggestion for receiving the tonsil. I may add that the wooden handle, dispensed with by Lucae, is one of the most important features in Physick's instrument, as it ensures steadiness and gives power. Some years ago Messrs. Mayer & Metzler made a double guillotine for me (Fig. 6), by means of which both tonsils can be simultaneously excised. The only objection to its use is that it acts equally on both tonsils, whilst it sometimes happens that more of one tonsil requires to be removed than of the other.

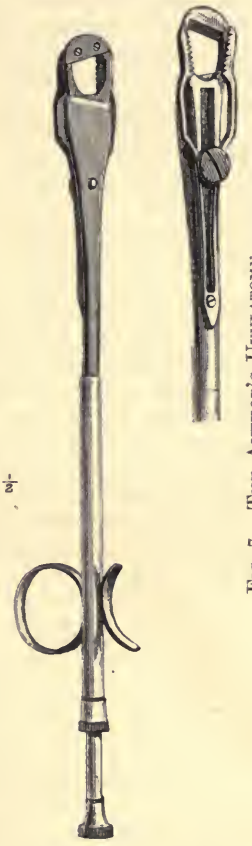

FIG. 7.—THE AUTHOR'S UVULATOME.

In the complete instrument the upper surface, with the cutting blade, is shown; whilst in the other drawing the under surface, with the forceps which seize the uvula when cut through, is seen.

*The Uvulatome.*—In speaking of tonsillotomes, it has already been shown that this instrument preceded, and, indeed, gave rise to the invention of the tonsillotome. The uvula-

[1] "Deutsche Medic. Wochenschrift," Nos. 11 and 15, 1877. I am indebted to Mr. Detert, the well-known Berlin instrument maker, for a very perfect specimen of Professor Lucae's guillotine.

tomes, however, which were in use in this country at the end of the eighteenth century were of very rough construction, and it was only when the introduction of the laryngoscope gave a great impetus to the study of throat affections, that the modern uvulatome was invented. The credit of greatly improving this instrument is due to Dr. Elsberg, of New York. His instrument consisted of a cutting blade which was drawn back until placed *in situ*, and was then suddenly discharged by touching a trigger in its upper surface. Beneath the blade were forceps, which seized the uvula as it was cut through. Finding, however, that this instrument was inconvenient in practice, as the strong spring imparted a great jerk to the instrument, whilst the blade often failed to cut through the uvula, I abandoned the spring and trigger arrangement and added a second cutting blade. One of the blades is pushed forward by the thumb whilst the other is a fixture at the distal extremity of the instrument. The two blades are arranged at such an angle that they correspond to the blades of a pair of scissors. In other words, as the moveable blade passes down over the one that is fixed, the aperture receiving the uvula forms an isosceles triangle until it is obliterated by the complete closure of the blades. In using this instrument, the free surface of the blade should always be directed upwards, and it is well to hold it somewhat obliquely, as by this means a tapering, instead of a truncated, uvula results from the operation.

# DISEASES OF THE PHARYNX.

## CATARRH OF THE PHARYNX.

(Synonyms: Pharyngitis. Sore Throat.)

*Latin Eq.*—Catarrhus pharyngis. Pharyngitis.
*French Eq.*—Angine inflammatoire, superficielle, ou catarrhale. Pharyngite.
*German Eq.*—Schlundkatarrh. Schlundentzündung. Halsweh.[1]
*Italian Eq.*—Catarro della faringe. Faringitide.

Definition.—*Acute inflammation of the mucous membrane of the pharynx, usually terminating in resolution, but in cachectic persons often causing a liability to future attacks, and leading ultimately to relaxation of the mucous membrane of the pharynx.*

*Etiology.*—Catarrh of the pharynx affects all classes, and is common at all ages. It is most frequent, however, in young persons. The strumous diathesis, general feebleness of constitution, and long-continued exposure to any influences which tend to depress the vital powers, such as contaminated air, bad food, impure water, &c., act as predisposing causes of the disease. Persons engaged in sedentary occupations, and dwellers in cities are more subject to the affection than those living an active country life. Catarrh of the pharynx is most prevalent at those seasons of the year when sudden changes of temperature and inclement weather are frequent, and the exciting cause of the malady is generally exposure to cold or damp. Those who have had syphilis, or been mercurialised, are very subject to the affection. Finally, the disease occasionally appears to arise from some peculiar condition of the atmosphere, which seems to engender it epidemically.

*Symptoms.*—The onset of pharyngeal catarrh is in most cases accompanied by slight feverish symptoms, and a general feeling of lassitude and depression. These phenomena, however, may be almost entirely absent, the first symptom complained of being a disagreeable sensation of dryness, and a stiffness in the throat in swallowing. As the morbid action becomes fully developed, considerable pain may be experienced in deglutition, whilst the voice becomes hoarse

[1] The Germans do not, as a rule, use popular names for the various inflammatory affections of the pharynx, but employ the generic term *angina* for all of them, with a qualifying description of the affection, thus: angina catarrhalis, a. tonsillaris, a. gangræosa.

and partakes of a nasal timbre. At the same time the patient may suffer from noises in the ears, and the sense of hearing may be temporarily impaired. The character of the symptoms depends on the extent and situation of the inflammation, and some writers have divided the disease into two varieties, namely, superior, and inferior, pharyngitis.[1] When the upper part of the pharynx is attacked, the swallowing and hearing are affected. On the other hand, should the disease be situated in the lower part of the throat, pain is caused by any movement of the larynx, and there is tenderness on pressure at the sides of the neck. When the whole tract of the mucous membrane of the pharynx is inflamed, there is a combination of all the phenomena. In all cases, after the first day or two, there is a considerable increase of the mucous secretion, and the patient resorts to constant efforts of coughing and hacking, in order to clear his throat. As a rule, resolution soon occurs spontaneously, and at the end of a week the parts have regained their normal condition. In very rare cases, however, the disease, which at first seemed a mild catarrh, develops into an active inflammation, or true *pharyngitis*. The symptoms are then greatly intensified. Occasionally, the inflammation extends to the larynx, and the symptoms of the pharyngeal affection are lost in the more serious phenomena of œdema of the glottis. Cases, indeed, have been placed on record by Bamberger,[2] Rilliet and Barthez,[3] and Rühle,[4] which have been thought to show that acute pharyngitis may rapidly prove fatal. In Bamberger's cases, however, as well as in those of Rilliet and Barthez, there was probably suppressed scarlatina, whilst Rühle's patient was also the subject of acute alcoholismus. In feeble persons, after the acute symptoms have passed off, there sometimes remains a persistent delicacy of the mucous membrane of the pharynx, which renders the individual peculiarly susceptible to subsequent attacks of a similar nature. Cases have been reported by Gubler,[5] Broadbent,[6] and others, in which a simple acute inflammation of the pharynx caused subsequent paralysis of the veil of the palate.

On inspecting the pharynx, in a case of ordinary catarrh, the mucous membrane is seen to be of a vivid red colour,

[1] Peter: "Dict. des Sc. Méd." Paris, 1864, vol. iv. p. 695.
[2] "Handbuch der Pathologie," &c. Erlangen, 1855, Abth. 1. s. 6.
[3] "Maladie des Enfants." Paris, 1855, p. 233, et seq.
[4] Volkmann's "Sammlung Klin. Vortr." Leipzig, No. 6, s. 9.
[5] "Archives Gen. de Méd." 1859-60.
[6] "Lancet." 1871, vol. i. p. 308.

and to present a dry shining appearance. Some tumefaction of the pillars of the fauces and soft palate is almost always present. Small veins, not visible at other times, may be perceived, and the uvula is often slightly œdematous and elongated. When the pharynx is more acutely affected, the mucous membrane of the posterior wall of the pharynx is swollen and of a bright red colour, looking like rich crimson velvet. Sometimes the epiglottis is also seen to be much swollen and congested. When the inflammation is on its decline, the surface of the mucous membrane is often streaked with dark coloured viscid mucus, which adheres to the parts with great tenacity.

*Diagnosis.*—Catarrh of the pharynx may be confounded with quinsy, but as the gland soon begins to swell when it is inflamed, the differentiation of the disease is quickly established.

*Pathology.*—The affection, when slight, is merely a fluxionary hyperæmia; when severe, an acute inflammation. In all cases the vessels are dilated, and the severity of the affection depends on the amount of submucous infiltration. The secretions contain a number of pus cells and micrococci.

*Prognosis.*—The great majority of cases terminate in resolution, and leave no troublesome after-effects. In cachectic persons, however, as already remarked, a permanent weakness of the mucous membrane is often the consequence of catarrhal inflammation, and the individual is rendered liable to repeated attacks of the same kind.

*Treatment.*—Few persons think it necessary to take medical advice, on account of an ordinary pharyngeal catarrh. Confinement to the house for a day or two, restriction to a light diet, and the avoidance of stimulants, are the only measures required in order to allow the disease to undergo spontaneous resolution. A wet compress, or mustard poultice to the neck, a hot foot-bath, and sucking ice expedite the cure. An opiate, especially the tincture of opium, taken early in the day—if possible, will generally cut short an attack. The stimulating effect of opiates is greatly diminished if the patient sleeps immediately after taking a dose. Hence the old plan of administering Dover's powder just before going to bed does not answer so well as that now recommended. From five to ten drops of laudanum generally produce the best effect. Larger doses act as a sedative, and instead of controlling the vascular action, lead to relaxation. A Turkish bath is a popular remedy which will also

frequently cut short an attack of pharyngeal catarrh. The disappearance of the local affection may, generally, be considerably hastened by prescribing a rhatany lozenge every three or four hours. After the acute symptoms have subsided, the mucous membrane may be braced up by astringent solutions. A few applications of the pigment of chloride of zinc or perchloride of iron (Throat Hosp. Phar.) are especially useful for this purpose.

The disposition to pharyngeal catarrh is best counteracted by the use of a cold bath in the morning, when sufficient reaction follows. The skin should, if possible, be made less sensitive by the use of rough towels and flesh-brushes, whilst hot rooms, late hours, and all habits calculated to relax the system, should be strictly avoided.

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## Uvulitis.

In some cases where the pharynx is inflamed, the violence of the morbid action appears to be expended on the uvula. Under such circumstances this part becomes intensely red, swollen, and elongated, or it may be highly œdematous, and have a pale translucent appearance. It may attain the thickness of one of the fingers, and hang down into the sulcus, between the epiglottis and tongue, or even pass into the larynx and give rise to distressing paroxysms of dyspnœa.

The *treatment* should consist of scarification or amputation. When the œdema is slight, the uvula may be scarified by means of a sharp-pointed bistoury. In a few hours after the operation the part generally returns to its normal size. When, however, the inflammation is very active, scarification sometimes only gives exit to a few drops of blood, and in such cases the best procedure is to amputate the end of the uvula with the uvulatome. A discharge of watery blood at once ensues, which greatly relieves the engorgement both of the uvula and the surrounding parts. Under these circumstances the inflammatory action usually undergoes rapid resolution

## RETRO-PHARYNGEAL ABSCESS.

(Syn. : Post-Pharyngeal Abscess.)

*Latin Eq.*—Abscessus post-pharyngeus.
*French Eq.*—Abcès rétro-pharyngien.
*German Eq.*—Retro-pharyngeal Abscess.
*Italian Eq.*—Ascesso retro-faringeo.

Definition.—*An inflammatory swelling containing pus in the posterior wall of the pharynx.*

*Etiology.*—This is essentially a disease of childhood, though it occasionally attacks adults. The youngest children may suffer from it, and several cases are reported in which the disease occurred in sucking infants.[1] The male sex does not show the preponderating predisposition to the affection which is seen in many other diseases of the throat. Bokai[2] has collected 144 cases, and of these 78 were boys, and 66 girls. It used to be supposed that the disease was most commonly the result of scarlatina, but Bokai's cases have clearly proved that the affection is generally idiopathic.

The following table abridged from that author well illustrates the causes of retro-pharyngeal abscess:—

129 cases were idiopathic,
7 appeared in the course of scarlet fever,
4 were due to cervical spondylitis,
3 were of hypostatic character,
1 was traumatic—due to a foreign body.

In a large number of the idiopathic cases the little patients exhibited a scrofulous diathesis.

In adults abscesses, not larger than a pea, sometimes form in the wall of the pharynx as the result of catarrh, but these cases do not belong to the class now under consideration.

*Symptoms.*—The inflammatory process which leads to the formation of an abscess behind the posterior wall of the pharynx is generally of an insidious nature. In most cases the symptoms are not sufficiently prominent to attract attention until the local swelling interferes seriously with respira-

[1] See a case by Besserer: "Abscess an der hintern Wand des Pharynx bei einem vier Monat alten Kinde," Schmidt's Jahrb., 1845, p. 198; also a case by Winternitz: "Retro-pharyngeal Abscess im Säuglings' Alter": Wochenschrift der Gesellschaft der Aerzte in Wien, 1861, p. 241.

[2] Jahrbuch für Kinderheilkunde, 1876, Heft 1 und 2.

tion and deglutition. On inspection of the pharynx, if the abscess is situated high up, the mucous membrane of the posterior wall can be seen bulging forwards, and presenting a red, smooth, and uniform surface—indicative of tension. On passing the finger (which in the case of children, in order to avoid being bitten, should be protected by being partly wrapped in a cloth) into the back of the mouth, a soft tumour can be perceived. When the abscess is in the lower part of the pharynx, its presence can be determined with the aid of the laryngoscope.

The symptoms vary somewhat according to the position of the abscess. If the tumour is situated at the upper part of the pharynx, deglutition, especially of solids, is difficult, and the voice partakes of a nasal intonation, but the occlusion of the passage is not usually sufficient to incommode respiration. When the bulging of the pharyngeal wall occurs opposite the larynx suffocative attacks are likely to be frequent and may prove fatal, whilst swallowing may, at the same time, be interfered with to a serious extent. If the abscess occupies the sides of the pharynx there is great danger that the pus may burrow into the cellular tissue of the ary-epiglottic folds and thus produce œdema of the glottis and fatal dyspnœa. In addition to the phenomena consequent on obstruction of the degluto-respiratory canal, there may be stiffness of the neck, or the head may be drawn to one side or thrown backwards, owing to extensive infiltration of the areolar tissue between the pharynx and vertebral column. Bokai considers that the position of the head affords a valuable diagnostic sign. When the abscess is situated laterally, as occurs in three-fourths of the cases, the head is inclined towards the healthy side. In some cases tumefaction of the lateral and posterior parts of the neck may be present, whilst contraction of the sterno-mastoid muscle may be so marked as to give the idea of tetanic spasm. During the first years of life, convulsions almost constantly accompany the disease, and Bokai observed facial paralysis in three cases. There is seldom, however, any fever in children. The symptoms of post-pharyngeal abscess often exhibit a remarkable resemblance to the phenomena of croup, for which disease I have known pharyngeal abscess to be mistaken on several occasions. In the majority of cases, a sudden termination of all the symptoms is brought about by the spontaneous bursting of the abscess, but in some instances the quantity of pus is so great as to suffocate the patient in its sudden

evacuation.[1] Wendt[2] states that the abscess, when left to itself, may give rise to fistulous tracks which extend in the direction of the thoracic cavity or in the skin of the neck.

According to Bokai, whilst idiopathic abscesses form rapidly—often in two days—secondary abscesses require a week or more for their development. Abscesses proceeding from disease of bones are still more chronic in their course. In conclusion, it may be observed that should the abscess depend upon caries of the vertebral column, the fact can generally be ascertained by noting whether pain is caused by pressure on the spinous processes of the cervical vertebræ.

*Diagnosis.*—Retro-pharyngeal abscess may be confounded with croup, with a foreign body in the larynx, or with œdema of the glottis. With respect to croup, the diagnosis can easily be established by attention to the condition of the vocal and deglutory functions in the two diseases. Thus, in croup, the voice is soon extinguished, whereas in post-pharyngeal abscess, it is usually only altered in intonation. Again, in croup there is no dysphagia, whereas in retro-pharyngeal abscess difficulty of swallowing is as prominent a symptom as dyspnœa. In addition, portions of false membrane being frequently coughed up in the croupous affection, the diagnosis may often be established from the appearance of the expectoration. The physical examination of the throat, when possible, will of course determine the nature of the disease. As regards a foreign body in the larynx, its presence may evoke symptoms similar to those of retro-pharyngeal abscess, but phonation is generally more troubled than in the latter affection. The history of the case, and the use of the laryngoscope, will, in many instances, complete the evidence as to the impaction of a foreign body in the laryux. On reference to the symptomatology of retro-pharyngeal abscess, it will be seen that a veritable œdema of the glottis sometimes occurs through extension of inflammation, or purulent infiltration, to the ary-epiglottic folds. The phenomena of the two maladies are thus occasionally combined.

*Pathology.*—The origin of these abscesses is probably to be found in the structure of the part attacked. The abundance of glandulæ in this situation has long been recognized, and the peculiar arrangement of the lymphatic vessels, as described by Dr. Edmund Simon,[3] is still more remarkable.

[1] See a case by Gaupp: "Wurtemb. Corr. Bl." xl. No. 23, 1870.
[2] Ziemssen's "Cyclopædia," vol. vii. p. 68.
[3] "Schmidt's Jahrbuch," vol. cvii. p. 161.

These conditions provide the nidus for the development of scrofulous inflammation, which is so likely to occur in young children predisposed to the disease by diathesis. The occurrence of abscess in cases of spondylitis is only in accordance with the phenomena commonly observed in inflammation of the osseous structures and their protecting periosteum.

*Prognosis.*—A favourable termination may generally be anticipated when the abscess is diagnosed early and a free exit given to the pus. Spontaneous evacuation of the matter is also commonly followed by an immediate amelioration of all the symptoms. The prognosis is most unfavourable where the abscess has been allowed to interfere with deglutition and respiration for so long a time as to produce slow asphyxia and marasmus. In those cases where the disease is connected with caries of the vertebra, the presence of a constitutional dyscrasia, and the impossibility of removing the cause of the affection, render the prospect of recovery less hopeful. Mr. Syme,[1] however, has reported a case in which recovery took place after the exfoliation of the greater part of the second cervical vertebra; and Günther[2] relates a still more remarkable instance in which the patient recovered after the removal of the third and fourth cervical vertebræ. Both these cases were probably syphilitic. In cases of spondylitis the malady pursues a tedious course, which exhausts the vital powers, and the abscess, if opened, is not unlikely to fill again.[3] As already pointed out, the sudden rupture of a large retro-pharyngeal abscess may give rise to immediate suffocation, and it must not be forgotten, as already pointed out, that, in infants, the formation of the pus is sometimes accompanied with convulsions. The prognosis may be gathered from a consideration of Bokai's cases.[4] The idiopathic cases are the least fatal, for out of 129 cases only 5 proved fatal. Of the 7 patients with scarlet fever 2 died, and of the 4 cases of cervical spondylitis 3 terminated fatally. The traumatic case also resulted in death.

*Treatment.*—If pus has not actually formed the case should be treated by ice both externally and internally. If suppuration has occurred prompt evacuation is the proper treatment. It has been suggested[5] that these abscesses may be

[1] "Edin. Med. Journ." April, 1826, p. 311.

[2] "Deutsche Klinik." 1856, p. 34. (Both this reference as well as the last one are given by Dr. Solis Cohen: "Diseases of the Throat," Philadelphia, 1872, p. 150.)

[3] In a case recorded by Abercrombie, the abscess had to be opened three times before the process of suppuration terminated. Quoted by Peter: "Dict. des Sciences Méd." Paris, 1864, vol. iv. p. 698.

[4] Loc. cit. [5] Niemeyer, 7th Germ. Edit. p. 519.

opened with the nail of the forefinger, but it is better to effect free evacuation by an incision at the most dependent part with the laryngeal lancet. Some practitioners recommend that a trocar should be employed with the view of avoiding the danger of the pus flowing into the larynx.[1] In all cases this contingency should be guarded against by bending the head promptly forwards the moment the incision has been made. Whilst the local affection is being attended to, constitutional treatment will usually be necessary in order to re-invigorate the depressed vital powers. In strumous children, cod-liver oil, phosphate of iron, and iodide of potassium will generally prove useful remedies, whilst in infants the tendency to convulsions may often be successfully combated by bromide of potassium administered every three or four hours in five-grain doses. Finally, when convalescence is established, a change of air and a course of sea-bathing will, in most instances, result in the re-establisment of the patient's health.

## RELAXED THROAT AND UVULA.

(Synonym : Chronic Catarrh of the Throat.)

*Latin Eq.*—Resolutio faucium. Uva descendens.
*French Eq.*—Relâchement. Atonie du pharynx. Elongation de la luette. Chute de la luette.
*German Eq.*—Erschlaffung der fauces. Verlängerung des Zapfens.
*Italian Eq.*—Rilassatezza delle fauci. Ugola allungata.

Definition—*Relaxation with slight congestion and swelling of the mucous membrane of the fauces and an increase in the length, and occasionally in the breadth, of the uvula.*

*Etiology.*—Relaxation of the throat and uvula, in by far the greater number of cases, probably originates in catarrh, or rather in repeated attacks of catarrh. The acute symptoms pass off, but the tissues do not recover their normal tone, and the result is a certain looseness of texture. Relaxed throat is a very common affection in variable climates, especially in those countries where there is a frequent combination of cold and wet weather. In some persons exposure to night air always brings on the affection. Prolonged stay in

[1] Abelin : "Retro-pharyngeal Abscess in Young Children." Nordiskt Medicinskt Arkiv. Stockholm, 1871, iii. No. 24.

overheated rooms, on the other hand, especially where much gas is burnt, may also give rise to it. Those who, whilst leading a sedentary life, are inclined to the pleasures of the table and a free indulgence in spirituous liquors, often suffer from relaxed throat. Indeed, the worst cases generally arise from the habitual abuse of the stronger forms of alcohol. In such cases there is often a sub-acute catarrh of the stomach, which extends upwards through the œsophagus to the pharynx. The affection when occurring early in the morning is brought on, from exposure or excess the previous evening, from hypostatic congestion of the throat occurring in the recumbent position, or perhaps from sleeping with the mouth open and the consequent drying of the mucus on the surface. When the relaxed condition, however, only causes trouble in the evening, it then probably results from fatigue. In a few instances relaxed throat appears to be due to some reflex irritation, and women suffering from uterine complaints are often troubled with this affection. Relaxation of the uvula may also arise in scrofulous children in whom there is often a generally relaxed condition of the system. In a few cases an abnormal length of the uvula has been observed to be a congenital malformation. Paralysis of the veil of the palate, consequent on progressive bulbar disease or diphtheria, also produces a falling of this part.

Relaxation of the pharynx rarely leads to any serious alterations in structure, and, though it may persist for years, seldom gives rise to anything more than a temporary inconvenience.

*Symptoms.*—On waking after a night's rest a person affected with relaxed pharynx experiences a peculiar fulness and stiffness of the throat, often accompanied with a disagreeable sensation, as if due to the presence of a foreign body. The throat feels dry and parched, and repeated efforts are made to dislodge the supposed cause of irritation. These symptoms may last for days together, but they often subside as soon as the patient has taken a sip or two of hot coffee or tea. The examination of the throat sometimes affords only negative results, but in most cases the fauces are seen to be relaxed and slightly swollen, the whole of the palate dependent, and the uvula elongated. There is also generally a varicose condition of the smaller veins. Sometimes the surface of the pharynx has a peculiar pellucid appearance from being covered by a transparent film of mucus. When the uvula is much affected the symptoms are more troublesome

and very persistent—a distressing, tickling cough often continuing during the whole day. In the worst instances the uvula may be so much lengthened as to be drawn into the larynx in inspiration. This event usually occurs when the patient is sleeping on his back, and he awakes suddenly with a suffocative attack. In cases of this kind the abnormal condition of the organ often produces nausea and vomiting by irritating the fauces and base of the tongue. On inspection the relaxed state of the uvula can at once be perceived. The mucous membrane and sub-mucous tissue are the structures affected, there being usually no increase in the bulk of the azygos uvulæ muscle. The mucous membrane sometimes forms a kind of opaline vesicle at the extremity of the uvula, and from this point a constant dripping of watery mucus may take place. It must not be forgotten, however, that considerable elongation of the uvula may sometimes exist without giving rise to any marked subjective symptoms.

*Pathology.*—The blood-vessels are dilated and gorged, and the tissues generally either swollen from serous infiltration, or thickened by semi-organized products. The glandulæ are usually both dilated and hypertrophied.

*Prognosis.*—A cure can nearly always be effected, if the patient avoids the causes of the disease, and submits to proper treatment.

*Treatment.*—The various exciting causes already referred to must be carefully avoided, and the patient must live in a dry and bracing atmosphere. If there be any hepatic congestion, or irregularity of the bowels, a glass or two of Friedrichshall or Pullna Bitter Wasser, should be taken early in the morning. If the affection be slight, the free use of a gargle of chlorate of potash, night and morning, will sometimes quickly relieve the unpleasant symptoms. Mildly astringent lozenges, such as rhatany and kino (Throat Hospital Phar.), taken four or five times a day, are very useful. When the affection is obstinate the local application of astringents, such as solutions of perchloride of iron (℥j. ad ℥j.) or chloride of zinc (grs. xxx. ad ℥j.), combined with the internal use of tonic remedies, will sometimes effect a cure. If, however, the uvula is much elongated and occasions troublesome symptoms, it should be shortened. Abscission of this fold of mucous membrane has been practised from a very early date.[1] The ordinary method is to cut off a small portion with a pair of

[1] See Aretæus Πέρι αἰτίων Καὶ σημείων, κ.τ.λ., LI. cap. viii.

scissors, whilst the extremity of the uvula is held with forceps. The operation is, however, more efficiently and rapidly performed with the aid of the uvulatome, in the manner already described. Occasionally severe and continuous hæmorrhage follows the little operation, but it can always be checked by slowly sipping a teaspoonful or two of the tannogallic gargle of the Throat Hospital Pharmacopœia. The immediate effect of the operation is generally to cause a painful sore throat. The patient can only swallow liquids, and even these cause pain. There is indeed sometimes *odynphagia* of the most severe character. Occasionally the pain extends to the ears, and severe spasmodic contractions of the pharynx may take place. In some instances, on the other hand, the operation does not give rise to any trouble, and in most cases the pain passes off in a day or two. The soreness of the throat may be greatly relieved by frequently sucking a marshmallow lozenge (Throat Hosp. Phar.). The bland substance of the lozenge adheres to the wound, and forms a protecting covering. The wound soon heals, and the advantages which result from the removal of the part are in most cases almost immediately experienced. The irritating fits of coughing at once subside, and a very great improvement often takes place in the patient's general health. *In cases where there is any follicular disease of the throat, it is most important to cure that affection before the uvula is amputated*, as owing to the after-pain caused by the removal of the uvula, patients will not submit to any further treatment, when they have recovered from the operation. Hence the patient remains uncured, and the operation, and he who performed it, are brought into discredit.

## ULCERATED THROAT.

*Latin Eq.*—Fauces ulcerosae.
*French Eq.*—Ulcerations de la gorge.
*German Eq.*—Geschwürige Pharynxentzündung.
*Italian Eq.*—Angina ulcerosa.

Definition.—*A superficial ulceration of the fauces, due to slight septicæmia.*

*Etiology.*—Ulcerated throat is an affection often encountered in debilitated persons exposed to the influence of septic poisons. During epidemics of anginose scarlatina or of diphtheria this form of sore throat is frequently observed amongst the attendants of the sick. The disease generally manifests

itself in persons who have been long exposed to unhealthy influences, or in those who have become weakened from constant watching, loss of rest, and insufficient exercise. Students who are diligent in hospital practice, and those passing much time in the dissecting room, are peculiarly liable to ulcerated sore throat, called by the Germans *angina nosocomii.*

*Symptoms.*—The first symptom of ulcerated sore throat is odynphagia, which is especially noticed in swallowing the saliva. The throat feels stiff and swollen, the tongue is furred, and the breath offensive. The pulse is generally weak, and the temperature slightly raised. There is great loss of appetite. Though the patient feels drowsy he is often unable to sleep, and there is a sense of general malaise and lassitude, and sometimes shooting pains in the limbs are experienced. The patient also frequently suffers from a splitting headache. On examination it will be seen that the tonsils are somewhat swollen and congested, and that there are one or more small, white, superficial ulcers on the surface of the tonsils or fauces. The ulcers are generally round or oval, and vary in size from that of a millet seed to a shilling, but they are sometimes even larger; when there are several ulcers they show no disposition to become confluent.

*Diagnosis.*—The conditions under which the disease arises, and its rapid development facilitate its diagnosis. The ulcers are seldom covered by any deposit or membrane, and there is generally no difficulty in determining the nature of the affection.

*Pathology.*—The disease is probably a low form of inflammation, in which there is a slight alteration in the constitution of the blood. The nutrition of the part is impaired, and molecular death takes place.

*Prognosis.*—This is always most favourable.

*Treatment.*—The patient should at once be removed from the insalubrious surroundings, and have the advantage of healthy atmospheric conditions. The bowels should be evacuated by the administration of a mild aperient, but, on account of the generally asthenic nature of the affection, mercurial cathartics are to be avoided. To combat the fever and the symptoms of septicæmia, quinine and ammonia should be administered as soon as the tongue has cleaned; and to relieve the local condition, antiseptic gargles (Throat Hospital Phar.) are often useful, especially those containing chlorate of potash, per-

manganate of potash, borax, carbolic acid, or chlorinated soda. Mildly astringent lozenges, such as rhatany or kino (Throat Hospital Phar.) may frequently be used with advantage. In some cases, however, owing to the great swelling, gargling and sucking lozenges are attended with so much pain that we must resort to some other plan of local medication. Under these circumstances the use of inhalations sometimes gives relief, and a soothing vapour, such as the Vapor Benzoini or Vapor Conii (Throat Hospital Phar.) may render good service. Warm inhalations are especially indicated when the inflammation is slight and circumscribed. On the other hand, when the inflammatory process is very acute, sucking ice answers best. Ice, applied in a bladder to the head, also at once removes the cephalalgia, so often present. The patient should be fed on bland and nutritious fluids, and a few glasses of good wine, well diluted with water, will be of service.

Under suitable treatment the patient rapidly improves, and convalescence is generally thoroughly established in a few days.

## GRANULAR PHARYNGITIS.

(Synon.: Follicular Pharyngitis. Granular Pharynx. Clergyman's Sore Throat. Chronic Pharyngitis.)

*Latin Eq.*—Dysphonia clericorum.
*French Eq.*—Angine glanduleuse. Angine granuleuse. Angine papillaire. Pharyngite glanduleuse. Pharyngite granuleuse.
*German Eq.*—Chronischer Pharynxkatarrh. Chronischer Pharyngitis.
*Italian Eq.*—Faringitide cronica.

Definition.—*Chronic inflammation of the follicles of the pharynx occurring in two forms—the* hypertrophic *and the* exudative. *In the* hypertrophic *form the diseased glands or the epithelial structures become enlarged, and appear as elevated granular bodies on the surface of the mucous membrane. In the* exudative *form the glands give exit to a white, inspissated secretion, which projects from the point of issue, or adheres in patches to the mucous lining of the pharynx. What relations—if any—the two forms bear to each other has not been determined.*

*History.*—The existence of this disease was scarcely recognized until 1846, when Chomel[1] published some remarks on a special state of the pharynx, which he called *l'angine granuleuse.* Nevertheless, as early as 1741, Van Swieten[2] had mentioned in his commentary on Boerhaave that the "mucous crypts" of the pharynx, larynx, and œsophagus, when obstructed and swollen, gave rise to troublesome symptoms, and to deficiency in the mucous secretion. The monograph of Chomel had scarcely been perused by the body of the profession when Horace Green,[3] of New York, published a treatise on the same subject based on careful observations of the malady during a period of more than six years. He gave a good description of the disease under the name of *follicular disease of the pharyngo-laryngeal membrane.* In 1851 Buron[4] read a thesis on chronic pharyngitis confirming the observations of Chomel, and in 1857 Guéneau de Mussy[5] still further elucidated the subject in the most systematic and exhaustive monograph that has yet appeared. The literature of the disease is now extensive, but although the objective and subjective symptoms have been well described, there is still considerable divergence in the views of the various authors, especially with respect to the pathology of the affection. The morbid anatomy of follicular disease of the degluto-respiratory tract has not yet been studied sufficiently thoroughly to enable us to determine the exact relations which the various appearances presented during life bear to each other.

*Etiology.*—The causes of follicular pharyngitis are *predisposing* and *exciting.* The strumous, gouty, and rheumatic diathesis[6] *predispose* to the disease. Heredity is con-

[1] "Gazette Médicale." 1846, p. 310.

[2] "Comment. in H. Boerhavii Aphor. de Cognosc. et Cur. Morbis, Lugduni Bat." 1741, vol. ii. p. 575.

[3] "A Treatise on Diseases of the Air-Passages," &c. New York, 1846.

[4] "De la Pharyngite Chronique, Thèse de Paris." 1851, No. 203.

[5] "Traité de l'Angine Glanduleuse." Paris, 1857.

[6] Since Guéneau de Mussy published his work, already referred to, French physicians have regarded the herpetic diathesis as a very frequent cause of the affection. The term "herpetic" is, however, so vague that I do not feel myself justified in making use of it. The most complete definition of the diathesis and its manifestations is given by Bouchut et Deprés in their "Dictionary of Medicine." In the following extracts the terms, *diathèse dartreuse*, *diathèse herpétique*, and *herpétisme*, are synonymous:—

*Dartres*—"Les maladies de la peau qui dépendent d'une diathèse autre que la syphilis, la scrofule, le rhumatisme ou l'alteration du

sidered by Green[1] to be an influential factor in its production. A majority of cases are met with between the ages of twenty-five and thirty-five years,[2] but the affection frequently shows itself much earlier. Thus Guéneau de Mussy[3] mentions instances occurring in children under fifteen years, and I have met with the disease in children of eight, six, and even three years of age. Amongst adults the malady is more common in the male than in the female sex—a fact which can perhaps be explained by the much greater exposure of men to the exciting causes. The delicate state of the mucous membrane of the throat, which often remains after severe attacks of influenza, scarlatina, measles, and small-pox, sometimes appears to render the individual liable to follicular disease. The most potent of all the *exciting causes* of granular pharyngitis is over-exertion of the voice. In those of sound constitution and good muscular development considerable exercise of the vocal organ is not followed by any bad effects, but, on the contrary, such exertion rather acts as a local tonic. When, however, the vital powers are naturally feeble, and the bodily conformation ill-adapted for prolonged and forcible effort, the over-exertion of any organ invariably impairs the activity of its functions and produces disease.

A very large proportion of the cases of granular pharyngitis which have come under my notice have been amongst

sang par les poisons et les virus sont des *dartres*. La disposition de l'organisme qui favorise l'apparition des dartres constitue *l'herpétisme*.

"Pendant la jeunesse les dartres (furfuracées, papuleuses, vésiculeuses, pustuleuses, squameuses, tubèrculeuses) occupent la peau, mais par suite d'un traitement répercussif ou par le fait des changements organiques opérés par l'âge elles se portent à l'intérieur, sur les muqueuses et engendrent les angines et les bronchites chroniques l'emphysème, l'asthme, la gastralgie, la diarrhée, la dyspepsie, le flux vaginal et une foule de maladies chroniques."

*Herpétisme.*—"La constitution de certains sujets favorable au développement des dartres ou des maladies internes dues au principe dartreux, est ce qu'on appelle *herpétisme*. C'est une diathèse qui produit à l'extérieur sur la peau, des vésicules, des pustules, des squames, des bulles et à l'intérieur des catarrhes muqueux chroniques d'où resultent un grand nombre de maladies viscérales graves."

*Herpétique.*—"Qui est de nature dartreuse. Ainsi on dit qu'un individu affecté de dartres est atteint de la diathèse herpétique."

The words *dartre*, *tetter*, and *zitter* are all supposed to be derived from the tremulous or twitching movement to which skin diseases sometimes gives rise. They seem too vague to be made the basis of a diathesis, which can only be formulated as a negation (see *dartres* above), but which is so comprehensive that it includes nearly all skin diseases.

[1] Op. cit. p. 159. [2] Ibid. p. 165. [3] Op. cit. p. 18.

those using the voice, such as the clergy, singers, hawkers, and costermongers. In almost every instance the evidence of constitutional delicacy is well marked, and most of the patients present an anæmic appearance. In nearly all cases where the origin of the affection cannot be attributed to over-use of the voice, the immediately exciting cause is exposure to cold. A series of three successive causes can thus be laid down as being in most instances concerned in producing the disease, viz. :—1. Constitutional predisposition (this includes any cachexia, but especially the strumous diathesis); 2. Over-exertion of the voice (with consequent weakening of the mucous membrane of the throat); 3. Exposure to cold—the latter being the most immediate, though not the most potent, of all the causes. In addition, the application of any irritant to the already weakened mucous membrane is capable of exciting the morbid action of the glandular apparatus. My own experience does not, however, coincide with that of Green[1] and Guéneau de Mussy[2] with respect to the use of tobacco. It is possible that, in certain persons, excessive smoking may cause congestion of the mucous membrane of the throat, and sometimes tend to produce a blocking up of the mouths of the follicles, but the abuse of tobacco more often leads to simple chronic relaxation. It has been asserted that those who are compelled to breathe constantly a tainted atmosphere, or to reside in a damp climate, are, *cæteris paribus*, most liable to be attacked by this malady; and that those who are subjected to the presence of irritating gases or powders in the atmosphere, as is the case in chemical works, metal factories, cotton mills, coal mines, &c., are prone to the disease. I have met with many cases in which the etiology could not be arrived at.

*Symptoms.*—Patients affected with follicular pharyngitis do not as a rule experience any painful sensations at the outset of the disease. The first symptoms are generally confined to a sense of stiffness and dryness in the throat, and a tickling cough. Should the patient, however, be subject to severe fits of coughing, he almost always complains that "it hurts him to cough"; and, on questioning him more closely, it can be ascertained that each impulse of coughing causes a feeling of tenderness and soreness about the upper part of the larynx and the arch of the palate. Amongst public speakers or singers the first symptoms which attract the attention of the patient, and generally occupy his mind to the exclusion of all

[1] Op. cit. p. 174. [2] Op. cit. p. 28.

other phenomena attendant on the disease, are hoarseness and a loss of power over the voice. As the morbid condition of the follicles increases, their functions are interfered with. Dryness and soreness of the throat supervene, causing the patient great inconvenience, and constituting what has been called *pharyngitis sicca*. An insupportable sense of pricking and heat is often felt in the pharynx, whilst a harsh, dry cough, accompanied by repeated hawking efforts, simulates pulmonary phthisis. The larynx almost constantly feels obstructed, and the sufferer is led to make continual fruitless attempts to clear the throat. Small quantities of viscid mucus are occasionally expectorated, whilst the strain of excessive coughing sometimes causes the sputa to be tinged with blood. In the most pronounced cases of granular pharyngitis the diseased condition of the follicles extends to the naso-pharyngeal space and posterior nares, to the front of the soft palate and uvula, and to the upper part of the larynx and œsophagus. As a consequence, therefore, of the implication of these parts the malady is sometimes accompanied by impairment of the senses of hearing, smell, and taste, in proportion as the orifice of the Eustachian tube, the pituitary membrane, or the mucous covering of the palate participate in the morbid process. Hoarseness and feebleness of voice result from the larynx being involved, and the general soreness and stiffness of the parts concerned in the production of speech cause a marked hesitation and effort in articulation. When the upper part of the œsophagus or the epiglottis becomes affected considerable pain in swallowing usually results, and some patients are reduced to the necessity of subsisting altogether on liquid food. The symptoms are, as a rule, much more marked in the exudative, than in the hypertrophic, form of the disease. As Peter[1] remarks, however, a considerable amount of enlargement of the follicles of the pharynx, &c., may exist, and, at the same time, give rise to so little inconvenience that the patient may be quite unconscious of there being anything unusual in the condition of his throat.

The objective symptoms of both forms of follicular pharyngitis are most characteristic, and at once strike the observer on making an inspection of the part. In the *hypertrophic form* of follicular disease, the locality of the throat first affected is the posterior wall of the pharynx. In the early stages of the disease the mucous membrane in this situation

[1] "Dict. des Sciences Méd." vol. iv. p. 749.

may be seen to be dotted with small elevations, about the size of a millet-seed, entirely isolated from each other. As the disease advances, these granulations increase in number until they become packed so closely together as to give a reticulated appearance to the part, and finally they coalesce and form broad, flattened elevations, or long ridges running in various irregular directions over the mucous membrane. In most cases injection of the superficial veins of the pharynx is present, and these vessels can often be seen pursuing a tortuous course along the furrows, or forming a kind of net-work round the elevations. As the disease advances the granulations become developed on the adjacent parts of the fauces and tonsils, and sometimes give rise to hypertrophy of these glands. Examination by means of the rhinoscopic and laryngeal mirrors will be required in order to estimate how far the naso-pharyngeal cavity, the lower part of the pharynx, and the larynx are implicated in the morbid process. Coincident with the appearance of these several phenomena there is always considerable perversion of the secretions of the pharynx. This derangement is almost always on the side of deficiency.

In the *exudative form* of follicular disease, the affection generally commences in the tonsils or in their immediate neighbourhood, and advances to the posterior wall of the pharynx, the back of the tongue, the epiglottis, and the interior of the larynx. In health the secretion of the follicles appears to the naked eye as a watery transparent fluid, but if the follicles become acutely inflamed their secretion (probably from increase of the corpuscular elements) becomes milky in colour and consistence. This condition is constantly seen in follicular tonsillitis. If the inflammation is less acute and more persistent, the milky secretion becomes inspissated, and leads to the formation of the caseous deposits so characteristic of the disease. In the earliest period, the throat is seen to be dry and glistening, whilst the orifices of the follicles are bright red, and the intervals of mucous membrane between them generally slightly hyperæmic. Later on, however, the diseased follicles discharge a morbid secretion, and viscid mucus is often seen adhering in patches to the follicles, or filling up the intervals between them. On pressing the enlarged follicles this exudation may be seen to issue from them, generally by a single, minute aperture, situated near the centre of the elevation. The secretion may have the cheesy character already described, or may resemble the

matter which can be pressed out of the follicles of the skin of the nose or face when affected with acne. Sometimes the secretion, after exuding from the follicles, adheres to the part in small white patches of irregular shape, about 1-16th of an inch in diameter, or hangs like a thread from 1-20th to 1-8th of an inch in length from the point of exit. On inspection, under these circumstances, the pharynx is seen to be dotted at numerous points, but especially about the pillars of the fauces and tonsils, by patches of white accretion resembling, in colour, consistence, and odour, decomposing cream cheese. According to my experience, ulcerations of any size or depth rarely occur as a direct consequence of follicular disease of the pharynx, and when present are generally due to some associated disease, such as syphilis or phthisis.[1] Sometimes the secretion is chalky in appearance, and calcareous in composition. Unlike the hypertrophic form of the disease, instead of there being any disposition to increase of tissue, the tendency appears to be of an opposite nature—*i.e.*, towards an atrophy of the structures and enlargement of the cavity of the pharynx. The case reported by Guéneau de Mussy,[2] in which calcareous matter could be pressed out of the follicles situated in and about the tonsils, seems clearly to belong to the exudative form of the disease, and although unique in that writer's experience, is a phase of the malady often met with in this country and in Germany.[3] A general relaxation and loss of tone of all the structures of the pharynx soon results from the disease, and the uvula becomes in some instances so much elongated as to rest on the base of the tongue, or even to hang down into the larynx.[4] Titillation of the base of the tongue and epiglottis by the elongated uvula, is one of the commonest factors in the production of the incessant, tickling cough.

*Pathology.*—The pathological varieties of this affection have not as yet been sufficiently worked out to enable us to determine the relations between the two kinds of granular disease. Whether the *exudative form* is the result of de-

[1] Green considers ulceration as frequent: Op. cit. pp. 51—180 et seq.

[2] Op. cit. p. 189.

[3] Wendt: Ziemssen's "Cyclopædia" (German edition), vol. vii. part I. p. 266.

[4] See a case depicted by Dr. Green in which suffocation nearly occurred on several occasions from the end of the uvula being drawn into the larynx during inspiration: Op. cit. p. 270.

generative changes in glandulæ previously hypertrophied, or whether the exudation is the product of a simple morbid secretion is at present unknown. The nature, differences, and extent of the morbid alterations in the mucous membrane and its secretory glands have yet to be elucidated, but the tendency of investigation is to show that the hypertrophic and exudative diseases, though they may co-exist, are totally distinct affections, differing in their symptoms, course, and pathology, and requiring, as is shown in this article, totally different treatment. According to Stoerk,[1] in the *hypertrophic form* the granulations consist of large, nearly round, swollen, epithelial cells, the layers of hard compressed cells or flattened scales which usually cover and protect the surface having disappeared. The morbid changes are in fact more in the epithelium than in the follicles. In a case of *exudative* disease reported by de Mussy,[2] where a microscopic examination was made by Drs. Sappey and Robin, the principal histological changes noted were as follows :—The tubules of the follicles were found considerably enlarged, both as regards the diameter of their cavity and the thickness of their walls. In the follicles which were most hypertrophied and indurated, small calcareous concretions were discovered, composed principally of carbonate of lime. In some of the glands these concretions were numerous, and packed together so closely as to present when detached a crystalline appearance, owing to their surfaces having been moulded into polyhedral, facetted figures. On the other hand, the cellular tissue connecting the secretory tubules and the epithelium lining their internal walls presented but little departure from the normal condition beyond a very slight thickening. With respect to the vessels of the hypertrophied follicles, the capillaries showed no perceptible change, but on the whole the diseased glands appeared to be less vascular than in the healthy pharynx.

The cheesy secretion consists of the *débris* of epithelial cells, of molecules, and oil globules.

*Diagnosis.* — The recognition of follicular pharyngitis, whether hypertrophic or exudative, presents no difficulty, and the condition can scarcely be confounded with any other disease. In cases where the cheesy exudation is very abundant and coats the surface of the pharynx, a person

[1] "Klinik der Krankheiten des Kehlkopfes." Stuttgart, 1876, p. 114. [2] Op. cit. p. 87.

who had never seen an example of either disease might suppose that diphtheria was present. As a rule, however, the discharge in the follicular disease adheres to the surface of the mucous membrane in small *isolated* patches, and is very different to the tough, membranous, exudation which occurs in the more serious malady.

*Prognosis.*—I cannot at all acquiesce in the opinion of Dr. Green[1] that pulmonary phthisis can ever owe its origin to granular pharyngitis. Nor is it more likely that when the follicles of the œsophagus become implicated in the morbid action, malignant disease of the gullet can ever be a direct consequence.[2] Phthisis, however, is sometimes associated with granular pharynx. Most cases of follicular disease of the pharynx get well under appropriate treatment, *i.e.*, as far as the troublesome sensations are concerned, but with respect to the vocal function, the prognosis is not always so favourable, especially as regards public speakers, singers, &c., if the disease has existed many years. The vocal organ is extremely likely to remain permanently weakened, at least to such an extent as to interfere with its constant professional use. The *exudative* variety of the disease is much more difficult to eradicate than the hypertrophic form.

*Treatment.*—As many writers have a strong belief in the purely diathetic character of the local phenomena attendant on granular pharyngitis, the treatment prescribed is often almost entirely limited to constitutional measures. In my experience,[3] however, topical applications have been so generally successful that I cannot but conclude that the local medication of the affected parts is the essential factor in treatment. The two forms of the disease as described in this article require a different method of topical treatment. When the *hypertrophic form* alone is present, no remedy is so productive of good results as the London paste (Throat Hosp. Phar.). This caustic should be applied to each granulation separately, but only two or three of the elevations, and in some cases only one spot, should be touched on the same day. The mode of procedure is as follows:—Having made the powdered preparation into a thick cream by rubbing it up with a sufficient amount of water, a small quantity of the

[1] Op. cit. p. 118. [2] Ibid. p. 129.

[3] See also Kunze: "Compendium der praktischen Medicin," p. 218; Niemeyer: "Pathologie u. Therapie," vol. i. p. 500; and Wendt: Op. cit. p. 278.

caustic is applied to the desired part with the pharyngeal spatula (page 9). Immediately after the application has been made the patient should be directed to gargle and wash out the throat with cold water, so as to remove any particles of the caustic that may remain adherent to the part touched. The London paste should be persevered with in this way until all the granulations are destroyed. As a rule, one touch of the paste is sufficient to remove a granulation, and establish a healthy action in the part; but if the elevation be very large, or if there be many separate raised spots, a number of applications may have to be made. It is scarcely necessary to observe that it is most important not to set up extensive inflammation by using the paste too freely on any one occasion. In some persons the application may be made every day, whilst in others twice or three times a week will be sufficient. In the intervals milder remedies can often be used advantageously—such as the pigmenta of perchloride of iron or chloride of zinc (Throat Hosp. Phar.); and when there is much irritation of the fauces, consequent either on the disease or on the action of the caustic, a sedative inhalation of Benzoin or Hop (Throat Hosp. Phar.) is beneficial.

It has been recommended that the elevations should be destroyed by galvanic,[1] or actual,[2] cautery; but as the granulations can be readily got rid of by a simple escharotic, complicated processes and alarming methods had better be avoided.

As regards the *exudative form* of follicular pharyngitis the local treatment can be carried out without having recourse to so strong a caustic as the London paste. My practice in such cases is first to scrape the mucous membrane wherever the white spots appear with the "pharyngeal curette," already described (p. 10), and having thus cleared away the secretion to apply the solid stick of nitrate of silver —which should be carefully pointed for the purpose—to each spot which discharges an abnormal secretion.

Whilst the local treatment is being accomplished, internal remedies calculated to give tone to the vital powers, and improve the general health of the patient should be administered. Struma, anæmia, syphilis, &c., must be met by the exhibition of cod-liver oil, iron, iodide of potassium, &c. After the topical measures have been completed, the per-

[1] Michell: "Deutsche Zeitschrift für Chirurgie," ii. Bd. 2 Heft.
[2] Foulis: "Glasgow Med. Journ." October, 1877.

manency of the cure may usually be established by change of air, residence at the seaside for a month or two when the season is suitable, or by directing the patient to use the arsenical waters of Mont Dore, the hot sulphur springs at Aix-les-Bains, Cauterets, or Weilbach, or the saline waters of Ems. By a course of mineral waters and sprays the local weakness and diathetic condition are both generally greatly ameliorated. In the case of strumous children, benefit often results from a stay at Woodhall Spa, whilst the bracing air of Harrogate, Tunbridge Wells, and similar places often proves invigorating.

## PUTRID SORE THROAT.

*Latin Eq.*—Cynanche maligna. Angina putris.
*French Eq.*—Angine gangréneuse. Angine maligne.
*German Eq.*—Angina Maligna oder Gangrænosa.
*Italian Eq.*—Angina maligna.

DEFINITION.—*Primitive gangrene of the pharyngeal mucous membrane, constituting an affection* per se, *and originating independently of any other malady, such as diphtheria, scarlet fever, &c.*

*History.*—As Peter[1] well observes, the history of this affection may be divided into three periods. First, the ancient period, when a belief, founded principally on the vague descriptions of Hippocrates and Aretæus, prevailed that the disease was a common one, whilst in fact almost all the reported examples were cases of diphtheria. Secondly, the period of Bretonneau, subsequent to 1821, when the researches of that observer proved that the so-called cases of gangrene were only instances of diphtheria, and that a true gangrenous lesion was rarely, if ever, present in that disease. As a consequence of this discovery a majority of the profession were led to affirm the non-existence of a primitive gangrene of the throat. Thirdly, the contemporary period, in which, owing mainly to the observations of Gubler[2] and Trousseau,[3] the existence of the malady has been clearly recognized, whilst the conclusion has been arrived at that the disease is an extremely rare one.

*Etiology.*—Malignant sore throat appears always to be the

[1] "Dict. des Sciences Médicales." Paris, 1866, vol. iv. p. 700.
[2] "Archiv. Générales de Méd." 1857, vol. ix. p. 513.
[3] "Clinique Méd. de l'Hôtel-Dieu." Paris, 1865, p. 324.

result of blood-poisoning. It sometimes commences as a severe inflammation, which quickly leads to gangrene; whilst at other times it is gangrenous from the commencement. I have met with several instances of the inflammatory form, but only one case in which gangrene was the initial local manifestation. Trousseau remarks that "It has for its fundamental character mortification of the mucous membrane of the pharynx, which takes place at the first onset of the malady, and occasionally spreads to the cheeks and lips. The disease is comparable to gangrenous stomatitis."

*Symptoms.*—In some instances sthenic phenomena, with considerable fever and local inflammation, indicate the advent of the malady, but in most cases the symptoms are adynamic from the first. A premonitory stage is not always present, and soreness of the throat rapidly becoming intensified is often the first symptom which disturbs the feelings of the patient. The gangrene frequently supervenes with great rapidity, so that in two or three days a portion of the pharyngeal mucous membrane may be sphacelated. In some cases there is considerable swelling of the cervical glands, but this lesion is not invariably present. As the morbid process becomes fully developed, it is in all instances accompanied by a remarkable prostration of the vital powers. A state of collapse comparable to that which occurs in cholera indicates the intensity of the blood-poisoning; there is great loss of body heat, and the pulse soon becomes slow and infrequent. Thus in one of Gubler's[1] cases the contractions of the heart sank to fifteen per minute. The extremely feeble condition of the circulation is shown by the pallor, coldness, and bluish discoloration of the skin, especially of the extremities. The expression of the face is strikingly altered and pinched. The patient generally dies from syncope, the intelligence often remaining intact to the last. In some cases, however, the sufferer becomes comatose, and occasionally symptoms of profound lesions of the thoracic or abdominal viscera are manifested. Should the lungs be affected copious hæmoptysis results; whilst, if the gangrenous process invades the alimentary tract, an abundant, fetid, diarrhœa supervenes, which all remedies are powerless to check. Occasionally a general tendency to hæmorrhage is manifested, and a persistent bleeding occurs simultaneously from the lungs, bowels, nose, mouth, and

[1] Loc. cit. p. 518.

even under the skin, which becomes covered with petechiæ, and ultimately sphacelated at the points of ecchymosis. Trousseau saw diplopia and phlebitis of all the superficial veins about the end of the third week. Sometimes œdema of the glottis quickly proves fatal to the sufferer, and I have treated three cases of this kind in which tracheotomy proved only a temporary palliative. Throughout the disease the odour of the breath is so extremely fetid that it is alone often sufficient to enable a practitioner who has once previously seen a case to diagnose the disease as soon as he enters the room of the patient. When, however, the gangrene is of very slight extent, this symptom may be absent.

On inspecting the pharynx in the first stage of the disease the appearances are generally by no means characteristic of the approach of so serious an affection, although the peculiar foul smell of the breath may be quite perceptible. As soon, however, as the process of gangrene has commenced, the back of the pharynx, the pillars of the fauces, and the tonsils can be seen covered with discoloured patches—sometimes almost black, which are slightly elevated above the surrounding surface, and forming eschars ultimately detach themselves from the tissues beneath. Ulcerations, variable in extent and depth, result from the separation of the sloughs. In the worst cases the disease makes constant progress in the direction of the mouth, the œsophagus, and the air-passages, and terminates its onward course only by the death of the patient.

Typical cases of this disease have been described by Gubler[1] and Trousseau;[2] and Rilliet and Barthez[3] have reported some instances as occurring in children under five years of age. Some of these followed an attack of scarlatina or measles, and do not belong to the diseases now under consideration, but others were evidently examples of primitive gangrene of the throat.

*Pathology.*—As most cases of putrid sore throat prove fatal, opportunities of studying the morbid anatomy of the disease occur from time to time. In those instances where the gangrene is circumscribed, patches of an oval or circular shape from one-twentieth to half an inch in diameter are found on the mucous membrane of the pharynx, and frequently on

[1] Loc. cit. [2] Loc. cit.

[3] "Archiv. Générales de Méd.." N.S. 12, 1841, p. 446, et seq. For other cases see Musset: "Union Méd." 1860, 2nd series, t. vii. p. 436; and Bouchut: "Gazette des Hôpitaux," 1858, p. 170.

the epiglottis and upper part of the larynx. The surface of these patches, after death, is depressed, and their colour varies from a dark grey to an absolute black. The edges are perpendicular, and of dirty yellow colour, and the mortified structures exhale a gangrenous odour. The process of destruction is generally confined to the mucous membrane and sub-mucous tissue. The beds of muscular fibre are laid bare, but their substance is usually intact, though sometimes softened. When the eschar has fallen off, the resulting ulcer has occasionally been observed to be covered with a delicate false membrane. In the worst examples of the disease the sphacelated patches can be noted in the larynx, trachea, lungs, œsophagus, and throughout the alimentary tract.

*Diagnosis.*—The peculiar gangrenous odour is sufficiently characteristic to enable a person who has once smelt it to recognize at once the presence of the mortifying process. Diphtheria is the only disease that can be confounded with putrid sore throat, but the resemblance is not sufficiently great to lead an observant practitioner into error. The greyish black patches in the pharynx may exist in both diseases, but in diphtheria they are at first whitish and gradually become darker, whereas in true gangrene the diagnostic appearance is present from the first moment that the eschars begin to form. In diphtheria the sub-maxillary and cervical glands frequently become much swollen at the outset of the disease, but in putrid sore throat these parts in some cases remain altogether unaffected, whilst in others the tumefaction is but slight. The fetor of the breath in diphtheria is not very perceptible at first, but gradually increases as the disease becomes developed. In putrid sore throat the distinctive gangrenous odour is present at the onset of the malady, and frequently even before inspection can detect any considerable lesion in the pharynx.

*Prognosis.*—As putrid sore throat is only a local manifestation of a profound blood-poisoning, the prognosis is necessarily extremely grave. But few cases of recovery are on record, and in most instances the patient has been carried off in a few days. Trousseau,[1] however, saw a case which ultimately did well, and the example related by Musset[2] also terminated in recovery. I have met with two cases which recovered, and three, already referred to, which proved fatal.

[1] Loc. cit. [2] Loc. cit.

*Treatment.*—Active measures are imperatively demanded in the treatment of putrid sore throat. Trousseau and Gubler had recourse to applications of strong hydrochloric acid, in order to destroy the diseased tissues, but, keeping in view the general nature of the malady, little can be expected from topical medication. Sedative and antiseptic gargles and sprays are the most suitable local remedies. For this purpose borax, myrrh, bromide of potassium, and permanganate of potash may be employed. The most important indication, however, is to gain time, and if possible support the vital powers until the phenomena of the blood-poisoning have passed away. With this view quinine and bark should be administered every three or four hours, and stimulants freely given. In the case successfully treated by Musset perchloride of iron—about 30 grains in the twenty-four hours—was given. Whatever drugs are chosen, the diet must be of the most concentrated and nutritious description, and strong beef tea, eggs beaten up with brandy, &c., must be administered every hour or two. Nutritive enemata, such as are recommended in the article on "Stricture of the Œsophagus," should also be had recourse to, when the condition of the throat interferes to any extent with deglutition.

## HERPES OF THE PHARYNX.

*Latin Eq.*—Herpes pharyngis.
*French Eq.*—Angine herpétique. Herpès guttural.
*German Eq.*—Herpes des Schlundkopfs. Herpetische Angina.
*Italian Eq.*—Erpete della faringe.

Definition.—*An eruption on the mucous membrane of the pharynx running an acute course analogous to that of herpes when appearing on the skin.*

*Etiology.*—Exposure to cold appears to be the principal cause of herpes of the pharynx. According to Gubler[1] the disease is a kind of eruption in the throat, constituting as it were the crisis of a fever *a frigore*. On this account it is most frequent in cold, damp climates, and at those seasons of the year when sudden changes of temperature and inclement weather prevail. In England it is a rare affection, and all

[1] "Mémoire sur l'Herpès Guttural," &c. "Union Médicale," January, 1858.

the cases I have met with have occurred in the spring or autumn. I have met with one case in which the disease attacked a child three years consecutively —the left side of the palate and wall of the pharynx being the parts affected on each occasion. Women, children, and delicate persons are most liable to the malady, owing doubtless to their being more easily overcome by cold. Féron[1] thinks that mental emotions have the power of determining an attack of herpes of the pharynx; whilst Bertholle[2] believes the affection to be often associated with some uterine disturbance, and states that it is most frequently seen in females at the menstrual periods. Peter[3] considers that the contact of irritating substances with the pharynx, such as hot condiments, and acrid, fetid, or miasmatic exhalations are often productive of the disease. Finally, Trousseau[4] has shown that herpes of the pharynx prevails to a great extent during epidemics of diphtheria, and that the herpetic eruption may resolve itself into diphtheritic patches, leading ultimately even to a fatal termination.

*Symptoms.*—Herpes of the pharynx is always ushered in by a premonitory stage of general malaise, and symptoms of pyrexia. In a period varying from a few hours to two or three days the patient experiences a sensation of soreness and heat in the throat, which is greatly increased by swallowing. In most cases the local malady provokes considerable salivation. The disease runs an acute course. After four or five days the subjective symptoms diminish greatly in intensity, and at the end of a fortnight the parts usually regain their normal condition.

On inspecting the pharynx at the outset of the disease, a variable number of single or grouped whitish, opaline, vesicles can be perceived. They usually occupy the soft palate, the pillars of the fauces, and the tonsils, and at the apex of each vesicle there is often a dark spot. The mucous membrane forming the base of each vesicle or group of vesicles is always inflamed, and presents a red, tumefied appearance. The number of vesicles varies greatly in different cases. Sometimes only one or two can be seen, whilst in the worst instances they are arranged so closely

[1] "De l'Angine Herpétique,"—"Thèse de Paris," 1858, No. 219.
[2] "De l'Herpès Guttural," &c. &c. "Union Méd." t. xxx. 1866.
[3] "Dict. des Sc. Méd." Paris, 1864, vol. iv. p. 715.
[4] "Clin. Méd. de l'Hôtel-Dieu." Paris, 1865, vol. i. p 307, et seq.

together as to become confluent. As Stevenson Smith[1] remarks, the soft palate is occasionally so sprinkled over with minute vesicles, of the size of the head of a pin, that it appears as if it had been dusted with white pepper. The duration of the vesicles is ephemeral; their existence varies from twenty-four to forty-eight hours, but in many cases they appear in successive crops. As the local morbid action pursues its course, the termination of the vesicular stage may take place in three different ways. In the mildest cases the vesicles disappear by reabsorption and leave no lesion to mark their former situation. In another variety of the disease the vesicles burst and a small circular ulcer results, which appears deep, owing to the tumefaction of the mucous membrane. In a day or two these ulcers cicatrize, the infiltration of the adjacent tissues is resolved, and the part resumes its normal condition. In the third and severest form of the disease ulceration takes place, but the sore, instead of healing, becomes covered by a false membrane resembling, both in appearance and structure, the exudation of diphtheria. These phenomena most commonly occur on the palate, and are rarely seen on the posterior wall of the pharynx. When the vesicles are very numerous the patches of exudation may unite at some places, so as to form sheets of false membrane of limited extent. In three or four days, however, the ulcers heal, the exudation becomes softened and detached, and the mucous membrane recovers its healthy state. In some cases the larynx or the orifices of the Eustachian tubes may be the seat of some of these vesicles. The respiration and hearing may be temporarily affected, but serious symptoms are seldom met with. Simultaneously with the outbreak of herpes in the throat, the same eruption may manifest itself in the mouth or on the lips, thus affording a clear indication for the diagnosis of the malady. Certain idiosyncrasies have also been observed in patients liable to suffer from this affection. Thus Tardieu[2] mentions the case of a young man, in whom herpes of the pharynx alternated for several years with a similar eruption of the internal surface of the prepuce. Other instances have been observed in which herpes of the vulva or a general eruption of the malady on the skin coincided with the existence of the pharyngeal affection.[3]

[1] "Edin. Med. Journ." Nov. 1863. "False Diphtheria," &c.
[2] "Manuel de Pathologie interne," 2nd edit. 1857.
[3] Gubler: Loc. cit. Peter: "Dict. des Sc. Méd." vol. iv. p. 715.

*Pathology.*—The consideration of the pathology of herpes belongs to the department of the dermatologist, and it is therefore unnecessary to enter here on a question which is fully treated in the text-books on skin-diseases. Suffice it to say that the malady is believed to depend on a defect in the innervation of the part brought about by exposure to cold. In addition, Gubler[1] has shown that the morbid action which in herpes causes the formation of crusts on the skin, may give rise to the evolution of a false membrane when the disease attacks mucous surfaces.

*Diagnosis.*—Herpes of the pharynx can only be confounded with diphtheria, and it is not possible in all cases to differentiate the two diseases with certainty. If the case is seen during the vesicular stage, nothing can be more easy than the recognition of the malady; but at a later period, in severe instances, when the pharynx has become the seat of several patches of false membrane, the most experienced practitioner may be deceived as to the nature of the disease. According to Peter[2] the diagnosis of herpes of the pharynx at this stage can only be deduced from the existence of one or both of two phenomena—viz., (1) the presence amongst the patches of exudation of small ulcers such as are commonly consecutive to the rupture of the vesicles, and (2) the appearance of small isolated spots of false membrane, the transparency of which indicates their recent formation, whilst their size and circular shape leads the observer to suspect the previous existence of a vesicle. The coincidence of a herpetic skin eruption with a doubtful throat affection materially assists the diagnosis, although the occurrence by no means affords conclusive evidence as to the nature of the internal malady. In the absence of all the distinctive marks mentioned above it is sometimes impossible to arrive at a definite opinion, and under these circumstances the case had better be treated as one of diphtheria—an error in that direction being least likely to lead to any evil results.

*Prognosis.*—Sporadic cases of herpes of the pharynx may be pronounced to be devoid of all gravity. When, however, the disease manifests itself during an epidemic of diphtheria, the observations of Trousseau, as to the probability of the milder affection becoming metamorphized into the more serious malady, must be borne in mind.

*Treatment.*—As the onset of the disease is generally accompanied by considerable fever a diaphoretic or febrifuge

[1] Loc. cit. [2] Loc. cit. p. 716.

medicine is often serviceable. In two cases I found tincture of aconite rapidly relieve the symptoms, and, in the case already referred to, of a child very subject to the disease, the internal administration of arsenic always rapidly effected a cure. The local pain must be met by the use of emollient and sedative gargles, and hot, soothing, inhalations, such as the Garg. Boracis, Garg. Pot. Brom., Vapor Benzoini, and the Vapor Lupuli, etc. (Throat Hosp. Phar.); or by the insufflation of starch and morphia (gr. $\frac{1}{4}$), once or twice a day. In the last stage of the malady when the patches of exudation are becoming detached, the fetor of the breath calls for the employment of antiseptic gargles, of which permanganate of potash in solution is the most effective.

## RHEUMATIC SORE THROAT.

*Latin Eq.*—Angina rheumatica.
*French Eq.*—Angine rhumatismale.
*German Eq.*—Rheumatische angina.
*Italian Eq.*—Angina reumatica.

Definition.—*An affection of the throat occurring in persons of rheumatic constitution, characterized by suddenness of attack, severe pain, and the local appearances of inflammation. The symptoms are fugacious, and frequently give place to some local rheumatic manifestation, such as torticollis, lumbago, or sub-acute articular inflammation.*

*Etiology.*—The poison of rheumatism is the precise cause of this affection, but its outbreak is generally due to exposure to cold. Persons who have had frequent attacks of simple inflammation of the pharynx or tonsils are liable to this form of sore throat should they at any time become the subjects of the rheumatic diathesis.

*Symptoms.*—The symptoms of rheumatic sore throat have been so well described by Trousseau[1] that I cannot do better than employ his words. "An individual," he observes, "subject to rheumatic pains takes cold. At the end of a few hours he experiences an extremely acute pain in the throat, so that he can scarcely swallow a drop of water, nor even his saliva, the deglutition of these small quantities of liquid causing much more suffering than that of an alimentary bolus. On examin-

[1] "Clin. Méd. de l'Hôtel-Dieu." Paris, 1865, t. 1. p. 332.

ing the throat the interior of the pharynx and the veil of the palate present a redness more or less pronounced. The uvula invaded by the inflammation is œdematous and elongated. All these phenomena are going to disappear with great rapidity, because they are fugacious, like most affections of a rheumatic nature. The next day the acute pain of this angina will have ceased as if by enchantment, at the same time that another pain will occupy the neck, producing torticollis; whilst the day after, one of the shoulders may be the part attacked. Again, another day, and the patient will complain of lumbago. As to the angina, its duration may vary from twenty-four to forty-eight hours. It is because they have had to deal with these rheumatic sore throats that the physicians to whom I have referred have been enabled to boast of having gained the power of averting incipient inflammations of the throat. Patients who have had several attacks of this kind of sore throat are able at the outset to distinguish the rheumatic affection from a veritable phlegmonous inflammation; but the physician cannot differentiate the two maladies in the first moments of their appearance." In many rheumatic patients the throat affection is an invariable precursor of a general attack of sub-acute rheumatism.

*Diagnosis*—This affection can seldom be diagnosed at its outset, unless the practitioner has observed similar previous attacks in the same person, but, as remarked by Trousseau, the patient himself is often able to distinguish by his sensations the rheumatic nature of the affection, if he has suffered before in the same way. The sudden disappearance of the angina, and the development of unmistakeable rheumatic symptoms in some other part of the body, is of course decisive.

*Prognosis.*—The sore throat of rheumatism is the least serious of any of the local manifestations of that disease, and the only gravity attached to the prognosis depends on the possibility that in the resolution of the angina the malady may select for its seat some more vital part.

*Treatment.*—The acute pain of the disease is best treated by the use of emollient and sedative gargles, whilst at the same time warm poultices, or spongio-piline, saturated with tincture of opium, may be applied to the neck externally. Constitutionally the specific remedies that are supposed to neutralize, or cause the elimination of, the rheumatic poison, such as bi-carbonate of potash, iodide of potassium, salicylic acid, &c., should be administered.

### Gouty Sore Throat.

In connection with rheumatic sore throat it may here be stated that there is also a species of angina dependent on gout.[1] I have met with several well-marked instances. In one case a gentleman who frequently suffered from attacks of angina became subject to gout, and was never again attacked with inflammation of the throat. In another case the patient was suffering from acute pharyngitis, when the symptoms suddenly disappeared, and an acute attack of gout developed in the great toe of the right foot; after three days the gouty inflammation of the toe disappeared, and acute hyperæmia of the pharynx supervened. Dr. Prosser James[2] calls attention to the rarity of the acute affection, though he thinks that the mucous membrane of the throat is prone to chronic inflammation in those of gouty constitution. The treatment should be conducted on the principles recommended for rheumatism, with such modifications as the different diathesis may require.

## TONSILLITIS.

(Synonyms: Quinsy. Cynanche Tonsillaris.)

*Latin Eq.*—Inflammatio tonsillarum.
*French Eq.*—Esquinancie. Amygdalite. Angine tonsillaire.
*German Eq.*—Angina tonsillaris. Amygdalitis. Entzündung der Mandeln.
*Italian Eq.*—Angina tonsillare. Tonsillitide.

Definition.—*Acute inflammation of the tonsils, which may be of superficial character, or extend deeply into the parenchymatous substance, and may terminate in resolution, abscess, or chronic enlargement of the glands.*

*Etiology.*—The causes of tonsillitis may be divided into *predisposing* and *exciting*. Amongst the former, the greatest prominence must be given to age. The disposition to the disease commences soon after puberty, and is extremely common between 15 and 20, reaching its maximum between 20 and 25. The disease is seldom seen in children before

[1] See Peterson: "Dissert. de Angina Arthritica," Upsal, 1793; also Barthez: "Traité des Mal. Goutteuses." Paris, 1855, p. 202, et seq.
[2] "Sore Throat." Churchill, 1878, p. 120, et seq.

the fifth year, and is equally rare in adults after middle age—scarcely any cases occurring after 50.

The following table of 1,000 cases treated by me at the Hospital for Diseases of the Throat illustrates the influence of age :—

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Under | 10 | years | .. | .. | .. | .. | 35 |
| 10 | to 15 | ,, | 36 | .. | .. | .. | 220 |
| 15 | to 20 | ,, | 184 | | | | |
| 20 | to 25 | ,, | 323 | .. | .. | .. | 542 |
| 25 | to 30 | ,, | 219 | | | | |
| 30 | to 40 | ,, | .. | .. | .. | .. | 143 |
| 40 | to 50 | ,, | .. | .. | .. | .. | 51 |
| 50 | to 60 | ,, | .. | .. | .. | .. | 9 |
| 60 | to 70 | ,, | .. | .. | .. | .. | *nil.* |

This table shows the sudden and remarkably increased proclivity to the disease soon after puberty; for whilst from 10 to 15 years of age there were only 36 cases, from 15 to 20 there were 184. Again, it illustrates the fact that quinsy is more common between 20 and 30 than at all ages put together. The sudden fall after 25 is also remarkable. It will be noticed that young children are very little subject to the disease—an immunity which is all the more curious, when it is borne in mind that chronic enlargement of the tonsils takes place in 26·5 per cent. of cases in the first decennium. In the 1,000 cases tabulated above, 597 were males and 403 females.

Enlargement of the tonsils, congenital or acquired, renders the individual prone to attacks of tonsillitis, and a person who has once been affected with the disease is very liable to have a second attack if at any time he should take cold. This rule holds good to such an extent that in some patients the tonsils, after repeated inflammations, seem to constitute a veritable *locus minimæ resistentiæ*. Under these circumstances these glands appear to sympathize with every irregularity of the body, and an error of diet occasioning a slight dyspepsia, or a derangement of the sexual organs in females, may give rise to an attack of tonsillitis. Constitutional delicacy, especially when dependent on the strumous diathesis, may also be mentioned as predisposing to quinsy; whilst the poison of gout and rheumatism[1] occasionally seem to favour the production of the disease.

The exciting causes of tonsillitis are almost invariably wet

[1] Desnos: "Dict. de Méd. et de Chirurg. Prat.," Paris, 1865, vol. ii. pp. 118, 449; Pollock: Holmes's "System of Surgery," vol. iv. p. 339.

and cold. A surface chill, especially about the head and neck, causes hyperæmia of the internal surface of the throat, and the tonsils are apt to suffer from temporary vascular engorgement. In proportion to the susceptibility of the individual the accidental hyperæmia is likely to lead to an attack of quinsy. It is commonly supposed that the disease is most prevalent in the spring and autumn in this country, owing to the sudden changes of temperature and inclement weather of those seasons.

This, though true of autumn, is a mistake as regards the spring, as the following statistics taken from cases treated at the Hospital for Diseases of the Throat conclusively show :—

| | 1872. | 1873. | 1874. | 1875. | 1876. | Total No. of Cases. | Mean monthly of 5 years. |
|---|---|---|---|---|---|---|---|
| January .. .. | 14 | 16 | 15 | 21 | 20 | 86 | 17·2 |
| February.. .. | 10 | 16 | 8 | 17 | 19 | 70 | 14·0 |
| March .. .. | 9 | 9 | 12 | 27 | 7 | 64 | 12·8 |
| April .. .. | 11 | 5 | 10 | 18 | 15 | 59 | 11·8 |
| May.. .. .. | 15 | 10 | 15 | 30 | 7 | 77 | 15·4 |
| June.. .. .. | 13 | 8 | 15 | 11 | 22 | 69 | 13·8 |
| July.. .. .. | 17 | 32 | 16 | 32 | 14 | 111 | 22·2 |
| August .. .. | 19 | 24 | 24 | 25 | 15 | 107 | 21·4 |
| September .. | 43 | 20 | 51 | 52 | 39 | 205 | 41·0 |
| October .. .. | 41 | 47 | 33 | 26 | 31 | 178 | 35·6 |
| November .. | 17 | 21 | 20 | 22 | 21 | 101 | 20·2 |
| December .. | 11 | 5 | 8 | 16 | 9 | 49 | 9·8 |
| | 220 | 105 | 235 | 297 | 219 | 1176 | 19·6 |

Mean monthly average .. .. .. .. .. .. 19·6
Average monthly mean of the three spring months (March, April, May) .. .. .. .. .. .. .. 13·33
Average monthly mean of the three autumn months (Sept., Oct., Nov.) .. .. .. .. .. .. .. 32·26

There is, however, a possible fallacy in the statistics, which must not be overlooked. From the above tables it would appear that quinsy is more than twice as common in July as it is in December, but it must be borne in mind that persons suffering from acute disease of the throat are far more likely to go out to a hospital in July than they are in December or even March or April. This probable source of error does not, however, apply to the comparisons between spring and autumn, as both seasons are about equally inclement in this country.

Tonsillitis seems to have occurred in an epidemic form in some few instances, but, from the published accounts,

there is great difficulty in distinguishing cases of simple tonsillitis from epidemics of scarlet fever.[1] One instance, however, has been described with such care and precision by Mayenc[2] that little doubt can remain as to the almost purely tonsillar nature of the malady. This epidemic occurred in 1818 at Gordon, in France, and lasted for upwards of five months, attacking males and females, from fifteen to thirty years of age, in almost equal proportion. Inflammation of the tonsils occurs not only as one of the phenomena arising from the specific blood-poison of scarlet fever, but it may also be present in connection with variola or measles. Desnos[3] states that prolonged residence in a very high temperature, especially if the air be vitiated, may produce an attack of quinsy. Tonsillitis may also originate from the inhalation of irritating gases or from swallowing caustic substances. In such cases, of course, the affection is only a part of a general lesion of the respiratory or alimentary tract. Finally, mechanical causes may give rise to inflammation of the tonsils. The most common of these are wounds, gunshot accidents,[4] the impaction of foreign bodies in the gland during deglutition, such as a piece of bone, the fragment of a fruit stone, &c.—and the accretions of cheesy or calcareous matter in the lacunæ of the tonsils.

*Symptoms.*—The symptoms attendant on inflammation of the tonsils vary, both constitutionally and locally, in proportion to the intensity of the morbid action in the part, and hence it is useful to make some division of the malady with a view to the due application of therapeutics. Vidal[5] separates tonsillitis into erythematous and phlegmonous, *i.e.*, superficial and deep, whilst Wagner[6] distinguishes no less than five different forms, viz., (1) simple or superficial, (2) lacunal or follicular, (3) parenchymatous, (4) tonsillitis with abscess in the substance of the gland, and (5) peri- or retro-tonsillar, abscess. Clinically, however, there is no well-marked line of demarcation between the five varieties enumerated by Wagner, and as regards treatment it is sufficient to make two divisions of the disease, namely: (1) superficial or follicular tonsillitis, and (2) deep or parenchymatous tonsillitis. The inflammation

[1] Vidal: "Dict. des Sciences Médicales," vol. iv. p. 19; also, Desnos: Loc. cit. p. 129.

[2] "Bulletin de la Faculté de Méd. de Paris." 1819, t. vi. p. 396.

[3] Loc. cit. p. 130.

[4] See a case consequent on a pistol shot, by Bédor: "Bull. de l'Acad. de Méd." 1833.

[5] Loc. cit.

[6] Ziemssen's "Cyclopædia," vol. vi. p. 911, et seq.

is generally limited to one tonsil. The symptoms which usher in an attack of quinsy are those of a general malaise, with thirst and heat of skin, and in the severer forms there may be a rigor, and occasionally vomiting. These manifestations are accompanied or quickly succeeded by a sense of stiffness and dryness in the throat, which leads the patient to make constant efforts at deglutition. By degrees the act of swallowing becomes more painful, and as the local inflammation increases the symptomatic fever rises—especially in persons who have not previously suffered from the disease—to such an extent that in the case of young persons the temperature in the first forty-eight hours may reach 105° Fahr. The constitutional phenomena are less marked in the follicular form of tonsillitis, and are most severe when the inflammation is about to lead to the formation of an abscess. In persons, however, who are subject to the malady the fever seldom runs high. In those of debilitated constitution the fever occasionally assumes a typhoid character, whilst the local affection after a few days subsides into a subacute form, in which the tonsils are partially covered with an ashy exudation, or honeycombed with ragged and indolent ulcerations. These local phenomena are most apt to occur when the lacunæ of the glands are blocked up by caseous matter or calcareous formations. In the ordinary run of cases, as the disease develops, the tonsil becomes so much swollen as nearly to block up the isthmus of the throat, and to fill almost the whole pharyngeal cavity, rendering deglutition so extremely painful and difficult that the patient is afraid to swallow nutriment even in the liquid form. In follicular tonsillitis the swelling of the tonsils is less considerable, but the mucous membrane is of a very bright red colour, and the follicles exude a white secretion, which slightly adheres to the point of exit, and gives the patient who examines his own throat the idea that he has several ulcers. In parenchymatous tonsillitis, there is not only great congestion and increase in size of the tonsils, but all the adjacent parts of the pharynx and palate may be seen to participate in the morbid action. A thick mucous secretion and a viscid saliva clog the mouth and throat of the sufferer, and respiration may be somewhat impeded. The voice acquires a nasal intonation, or is reduced to a mere whisper, the mouth can scarcely be opened, the head is moved with difficulty owing to the swelling of the deep tissues of the neck, and the breath is intolerably fetid. Under these circumstances it is often difficult, and sometimes impossible, to get a view of the inflamed tonsils. In many cases—

especially in the follicular form of the affection—after the disease has lasted two or three days the pharynx becomes covered with a layer of dirty, yellowish, mucus, which bears some general resemblance to the false membrane of diphtheria, and has sometimes led to an error in diagnosis. The mucous secretion, however, which covers the tonsils in quinsy, possesses neither texture nor adherency, and can easily be wiped off the surface of the glands.

Velpeau[1] and Béraud have observed instances in which the inflammation extended through the cellular tissue of the neck as far down as the clavicle; whilst Morgagni[2] and MM. Rilliet and Barthez[3] report cases in which tonsillitis terminated fatally by suffocation. In almost all severe attacks of quinsy the hearing is affected, and occasionally the extension of the disease up the Eustachian tube gives rise to inflammation of the middle ear.[4] Œdema of the glottis is also a complication of quinsy, but happily a rare one; the inflammation, however, more frequently extends to the epiglottis[5] and the base of the tongue.

Follicular tonsillitis usually undergoes spontaneous resolution in three or four days, but in parenchymatous inflammation or abscess of the tonsil a healthy condition of the parts is not generally re-established for ten days or a fortnight, and the disease may even be protracted for three or four weeks. Slight ulceration of the tonsils nearly always remains when the inflammation has caused the extrusion of inspissated cheesy matter or calcareous concretions which had previously blocked up the lacunæ of the glands. Occasionally a number of small superficial abscesses or pustules form on the surface of the tonsils, and these abscesses on discharging themselves give rise to ulcerations which, in cachectic persons, are very obstinate in healing. Gangrene is a very rare termination in tonsillitis, but may happen as a consequence of the highest degree of parenchymatous inflammation. Cases have been seen by Grisolle,[6] Trousseau,[7] Frank,[8] and especially by Borsieri,[9] according to whom the phenomena of such an issue

[1] "Manuel d'Anat. Chirurg." Paris, 1862. The authors demonstrate the continuity of the areolar tissue covering the tonsil with the general areolar tissue of the neck.

[2] "De sed. et Caus. Morb." epist. xliv.

[3] "Traité des Mal. des Enfants." 1853, vol. i. p. 227.

[4] Follin: "Gazette Hebdomadaire." 1864, p. 155.

[5] Louis: "Bulletin de Thérap." 1843.

[6] "Traité de Pathologie Interne," t. i. Art. "Amygdalite." 1862.

[7] "Clinique Méd. de l'Hôtel-Dieu." Paris, 1865, 2nd ed. t. i. p. 392.

[8] "Traité de Médecine Pratique, trad. de Double." 1842, vol. i. p. 114, vol. ii. p. 164.

[9] De Angina, "Institutiones de Méd. Prat." 1798, t. iii. p. 343.

are a sudden diminution of pain and dysphagia, the appearance of a bluish patch on the tonsil, and after a day or two the expectoration of a putrid, sanious matter, having a peculiar odour, which Borsieri thinks pathognomonic of the occurrence. I have never met with such a case. When tonsillitis proceeds to suppuration, the patient usually complains of lancinating pains in the part, and well-marked rigors generally precede the formation of an abscess. It is unusual for both tonsils to become the seat of an abscess, but when such an occurrence does take place, suppuration very rarely occurs in both glands simultaneously. One gland becomes affected after the other has suppurated, and the inflammation may terminate in abscess. As a rule, the pus shows a tendency to evacuate itself at the anterior part of the tonsil, and the abscess projects towards the mouth. Occasionally, however, it points near the posterior wall of the pharynx, and under extremely rare conditions may make an opening for itself externally at the angle of the jaw. If the abscess be not opened by the surgeon and do not burst spontaneously, it may occasion so much swelling internally as to interfere seriously with respiration. Professor Stoerk[1] has pointed out that fluctuation may often be detected at a very early period by placing the fingers of one hand below and behind the ramus of the lower jaw, and pressing the soft tissues inwards, whilst the index finger of the other hand is introduced into the mouth and placed in contact with the inflamed part. In some cases the pus has been known to burrow through the cellular tissue of the neck as low down as the upper surface of the clavicle.[2] In a case reported by Montague,[3] the quantity of matter was so great that the patient, a young soldier, was suffocated by the sudden bursting of the abscess. At the post-mortem examination the larynx and the upper part of the trachea and œsophagus were found filled with pus. Such an accident as the foregoing is most to be dreaded should the abscess burst during sleep. A curious case is recorded by Roche,[4] in which the pus from a tonsillar abscess passed along the course of the great vessels of the neck and penetrated into the chest. Abscess of the tonsil is also dangerous on account of the external face of the gland being in close proximity to the internal

[1] "Klinik der Krankheiten des Kehlkopfs." Enke, Stuttgart, 1876, p. 109.
[2] Velpeau: Loc. cit.
[3] "Dissert. de Anginâ Tonsillari," &c. Strasbourg, 1823.
[4] "Dict. de Méd. et de Chirurg." Art. "Amygdalite." 1829.

carotid artery. After middle life, according to Chassaignac,[1] the artery in this situation describes a curve with the convexity directed inwards, which brings it still closer to the tonsil. Grisolle[2] mentions a case in which the abscess gave rise to ulceration of this vessel, and thus to serious hæmorrhage; whilst Caytan,[3] Müller,[4] Norton,[5] and others report similar instances which led to an immediately fatal result. Chronic enlargement often remains after the acute inflammation of the glands has passed away.

Paralysis of the pharynx and palate, with or without anæsthesia, somewhat similar to that which so often follows diphtheria, is also an occasional consequence of a severe attack of quinsy.[6] It is a rare condition, and when present is generally limited to the side of the throat which has been the seat of the tonsillitis. Paralysis of the pharynx is indicated by a difficulty in articulating those sounds which require the closure of the posterior nares, and by slight dysphagia, which is found to persist long after all the acute symptoms of the malady have subsided. The difficulty exists in making the first effort of deglutition, and can usually be overcome by a little resolution on the part of the patient. As soon as the bolus passes below the superior constrictor, it proceeds downwards to the stomach without any further difficulty. When the soft palate is alone affected, and the rest of the pharynx escapes, the symptoms are less marked. There may be, however, slight difficulty in swallowing—especially fluids, and nasal intonation of the voice. These palsies are, however, such rare sequelæ of quinsy that it is scarcely necessary to refer to them except as possible results.

*Pathology.*—As tonsillitis so rarely proves fatal, few opportunities have occurred where the pathologist could demonstrate the precise effects of acute inflammation on these glands. When the morbid action is superficial the mucous membrane, which covers the tonsils and dips into the lacunæ, is almost the only structure affected. In cases of

[1] "Leçons sur l'Hypertrophie des Amygdales." Paris, 1854, p. 7.
[2] "Traité de Pathol. Interne." Paris, 1862, t. i. p. 269.
[3] "Prager Vierteljahrsschrift." 1861.
[4] "Wurtemberger Med. Corresp. Blatt." 1855.
[5] "The Throat and Larynx." London, 1875, p. 12. Mr. Norton's patient was a little girl æt. four.
[6] See cases by Maingault: "Sur la Paralysie du Voile du Palais à la Suite d'Angine," Paris, 1853; Gubler: "Mémoires sur les Paralysies," &c.; "Archiv. de Méd." 1860-61.

parenchymatous inflammation, however, a much more important series of phenomena may be observed. Thus, in an instance recorded by Didelot,[1] the autopsy revealed extensive suppuration in the substance of the right tonsil, whilst the uvula was œdematous, and the mucous membrane of the palate infiltrated with pus. In addition, the base of the tongue was thickened and engorged, the follicles being filled with a concrete sebaceous matter, and a section of the organ showing effusion of pus between the muscles. In the case of Montague already referred to, inflammation and thickening of the walls of the internal jugular vein and its branches were found at the post-mortem examination. Pus and clots were also present in the interior of these vessels, which accounted for the engorgement observed in the sub-maxillary and parotid glands and the neighbouring lymphatics.

The tonsils often remain persistently enlarged after an attack of tonsillitis—the result of thickening and induration of the parenchyma of the gland.

*Diagnosis.*—The diagnosis of tonsillitis presents little difficulty. Nevertheless mistakes are frequently made, and the high mortality attributed to this disease in the annual returns of the Registrar-General, to be hereafter referred to, must be due to this cause. I have twice been consulted in cases of tonsillitis mistaken for laryngitis. In both affections there may be pain in swallowing, but when the larynx is the seat of inflammation the voice almost always becomes hoarse or is reduced to a mere whisper at an early period of the attack. In the laryngeal disease inspection of the pharynx at once shows the absence of any lesion in the upper part of the throat, whilst the laryngoscope reveals the actual condition of the larynx. Some discrimination is required in order to distinguish the sore throat of the first stage of scarlet fever from tonsillitis. Even hydrophobia has been mistaken at its outset for quinsy. The whitish follicular secretion, which often veils the tonsils in tonsillitis, has caused the affection to be mistaken for diphtheria, and has led to the supposition that the more serious disease had been cured by some simple measures. In all cases it is well to suspend the judgment for twenty-four hours, after which time the divergence of symptoms in any of the maladies which simulate quinsy is so apparent that the careful observer can usually arrive at a positive decision.

*Prognosis.*—The prognosis as regards life is so seldom

[1] "De l'Amygdalite Aigue"—"Thèse de Paris," 1850, No. 153.

unfavourable that the rare cases which terminate fatally must be viewed as merely accidental.[1] It is well, however, to bear in mind the possibility of such casualties in order to foresee and obviate them when the symptoms announce the advent of grave complications. With respect to complete recovery the prognosis in tonsillitis is not always favourable, though it usually is so in patients of sound constitution. In debilitated persons there is great probability of hypertrophy and chronic inflammation of the tonsils remaining after a severe quinsy. A liability to frequent subsequent attacks is also one of the most troublesome after-consequences of this disease.

*Treatment.*—The *superficial* forms of tonsillitis generally undergo spontaneous resolution in two to five days, and call for little treatment beyond such simple measures as confinement to the house, a light diet, and a dose or two of some mild aperient. A rhatany lozenge (Th. Hosp. Ph.) taken every three or four hours will also materially hasten the cure of the disease. In cases of *deep tonsillitis* the treatment required is much more active, but fortunately there is a remedy which if administered at the outset of the attack will almost always cut short the crescent inflammation. This is guaiacum. Dr. Home,[2] who well remarked, *instar specifici in hoc morbo operatur*, did not at all overstate the influence of the drug. It was formerly much given for this complaint in the form of the ammoniated tincture, but fifteen years ago Dr. Crompton, of Manchester, recommended me to try it as a powder. Taken in this way it seems to have a local as well as constitutional effect. Soon after I prescribed it as a lozenge, and it is now largely used in that form. A lozenge containing three grains of the resin (Th. Hosp. Ph.) given every two hours will seldom fail to arrest the disease at its first onset. Tincture of aconite in doses of two to five minims every three hours is sometimes very efficacious. This remedy, for which

[1] According to the Registrar-General's Returns, 226 persons died of quinsy in England in 1875, and the number has varied between 110 and 569 every year since 1848, except in the year 1858, when 623 deaths were returned. It is well to bear in mind that in that year diphtheria attained great epidemic force, whilst it was still but little understood and sometimes altogether unrecognized. The mortality returns gradually decreased from that time, and fell as low as 110 in 1872. It is scarcely necessary to point out that these returns are the results of errors in diagnosis, and it is a matter of regret to find that lately there has been a slight increase in the returns. Thus in 1873 the reported deaths were 158; in 1874, 173; and in 1875, 226!

[2] "Principia Medicinæ," part iii. sec. 4.

we are in a great measure indebted to homœopathy, has been strongly recommended by Dr. Ringer,[1] who advises that half a drop or a drop of the tincture, in a teaspoonful of water, should be given every ten minutes or quarter of an hour for two hours—and afterwards hourly. According to Dr. Ringer, a high temperature both affords the indication for the administration, and assures the success, of this remedy. In my hands this drug, however, has not proved so useful as guaiacum. When the disease is not seen at the commencement, the above remedies will fail to shorten its course, but the constant sucking of ice may still sometimes prevent the further development of the attack. We must also have recourse to such general therapeutic measures as are calculated to guide the morbid action to a favourable issue. The bowels should be kept open, the diet should consist entirely of nutritious soups, milk, &c., whilst locally, mildly astringent or sedative gargles, of tannin, borax, opium, &c., may sometimes be used with advantage. The immediate sensations of the patient are the best guide as to the use of different kinds of gargles, or, indeed, as to the employment of gargles at all. Sometimes they cause great pain, and should not then be used. A dose of Dover's powder at bedtime is also very beneficial when there is much fever and vascular excitement. Some practitioners have confidence in the direct application of mineral astringents, and Velpeau[2] especially recommends powdered alum and nitrate of silver. The pigment of chloride of zinc (Th. Hosp. Ph.) brushed over the inflamed tonsils two or three times a day is sometimes productive of great benefit, and even less frequent applications often do good. I quite agree with Trousseau, however, that there are certain cases in which the inflammation inevitably leads to suppuration, and that in these cases all remedies are powerless to turn it from its path. The morbid action marches onwards, unchecked in its course, until the formation and discharge of pus announces the completion of the process. In these cases of *tonsillitis with abscess* the best endeavours of the medical attendant should be directed to encouraging suppuration and shortening the stages of the disease. With this view a constant succession of warm poultices should be kept applied to the throat, whilst the patient should make persevering use of hot inhalations of steam to which some

[1] "A Handbook of Therapeutics." London, 1872, p. 385.
[2] Op. cit. t. 1. p. 453.

sedative, such as benzoin, hop, or conium (Th. Hosp. Ph.) may be added, and he should also gargle frequently with warm water. As soon as pus has formed, it is better to open the abscess at once than to leave it to evacuate itself spontaneously. The incision should be made with the pharyngeal bistoury, the point and cutting edge of the knife being directed upwards and inwards towards the median line. In the case of very nervous persons who are afraid of the knife, the immediate rupture of the abscess may often be attained by the administration of an emetic. Once the matter is evacuated, relief is generally almost instantaneous, though convalescence may occasionally be retarded in those of feeble organization. On this account it is always important to sustain the constitutional powers as far as possible.

Formerly the abstraction of blood, either general or local, was the primary treatment in all cases. The researches of Louis,[1] however, proved how little benefit may be expected from general bleeding. Thus, out of twenty-three patients suffering from parenchymatous tonsillitis noted by that observer, thirteen underwent venesection and ten were treated by other methods. The duration of the disease in the former cases was, on an average, nine days, whilst in the latter it was ten and a quarter days. This slight abridgment of the course of the malady cannot therefore be considered to compensate for such energetic interference. With respect to local bleeding it has been recommended to apply leeches at the angle of the jaw or to scarify the tonsils with the pharyngeal bistoury. If only one or two leeches are applied to each side, the effect appears to be the opposite to that desired, and an increased congestion of the tonsils often results. The good effect of the local abstraction of blood can only be obtained by the application of from three to six leeches on either side. A special kind of local blood-letting, *i.e.*, opening of the ranine veins, has within the last twenty years been practised to a considerable extent, and much vaunted in certain parts of France. The principal advocates of this measure, which is as old as Hippocrates, are MM. Arago[2] and Aran.[3] The latter writer insists on the incision being made longitudinally in the veins in order to avoid wounding the ranine arteries, an accident which, on account of the serious hæmorrhage it

[1] "Lancette Française," 1833.

[2] "Bulletin Général de Thérapie," &c., 1853. Also Mestivier, Ibid. 1857.

[3] Ibid. 1857.

entails, would be likely to bring this kind of bleeding into disrepute. Although I have never seen any cases in which such heroic remedies were called for, the proceeding certainly appears to have been attended with remarkable success in the hands of Aran.

In cases where the swelling of the tonsils is so great as to threaten suffocation, and where it cannot be diminished by the escape of pus, we must follow the example of Ancelon,[1] and at once excise the inflamed masses. In the middle ages tracheotomy was suggested in such a juncture, but the operation was not actually performed under these circumstances until the last century. In a recent instance, related by Puech,[2] of a man, æt. 33, who was evidently dying from asphyxia, and on whom the attempt to excise the tonsils had failed, recourse was had to tracheotomy with the result of saving the life of the patient. Tracheotomy was also performed by Mr. Alexander Shaw[3] under similar circumstances.

Should tonsillitis terminate in gangrene, treatment by antiseptic gargles will be sufficient until the sphacelated portions of the tonsil become detached, when the raw surfaces remaining will usually heal rapidly under applications of nitrate of silver.

## ENLARGED TONSILS.

*Latin Eq.*—Tonsillæ intumescentes.
*French Eq.*—Hypertrophie des amygdales.
*German Eq.*—Hypertrophie der Tonsillen.
*Italian Eq.*—Tonsille ipertrofiche.

DEFINITION.—*Chronic inflammation of the tonsils, giving rise to persistent enlargement and multiplication of the constituent structures of the diseased part, and to impairment of the functions of the glands.*

*Etiology.*—Hypertrophy of the tonsils is sometimes congenital, and is often met with in the first months of life. The affections so common in infants, such as purulent ophthalmia, eczema and impetigo of the face and scalp, nasal discharges, &c., are probably the exciting causes in the earliest months of existence. The disease not unfre-

[1] "Gazette des Hôpitaux." 1857.
[2] "Gazette Hebdomadaire." 1857, p. 592.
[3] "Medical Gazette." 1841, p. 190.

quently becomes developed for the first time about the age of puberty, owing, as some suppose, to a sympathetic connection between the sexual organs and the tonsils.[1] The following table[2] contains an analysis of the ages of 1,000 patients seen by me at the Hospital for Diseases of the Throat :—

| | | |
|---|---|---|
| 1 to 5 .. .. 84<br>5 to 10 .. .. 181 | Under 10 years .. .. | 265 |
| From 10 to 20 ,, .. .. | | 382 |
| 20 to 30 ,, .. .. | | 219 |
| 30 to 40 ,, .. .. | | 103 |
| 40 to 50 ,, .. .. | | 27 |
| 50 to 60 ,, .. .. | | 3 |
| 60 to 70 ,, .. .. | | 1 |

Probably many of the cases in the earliest period were either congenital or made their appearance very soon after birth.

Sex is not without some influence in producing the affection, for out of the 1,000 instances recorded in the preceding table, 673 were males and 327 females. Some cases of hypertrophy of the tonsils result from an attack of quinsy, but a cachectic state of the constitution, especially if due to the strumous diathesis, more often originates the disease. The morbid condition of the glands may frequently be observed to date from a severe attack of scarlatina, measles, or small-pox with throat complications ; and Lambron [3] mentions four instances in which the malady was consequent on an attack of diphtheria. Syphilis, hereditary or acquired, is also capable of producing chronic inflammation of the tonsils, and granular pharynx [4] is, in some instances, the immediate cause of the malady. Chassaignac [5] mentions a case of nasal polypus which appeared to have had some effect in giving rise to tonsillar enlargement. As a rule, hypertrophy of the tonsils, by whatever influence established, tends towards a spontaneous cure after the age of thirty, and subsequently to that period of life the volume of the glands diminishes so steadily and constantly that the decade of from forty to fifty affords few instances of the disease.

[1] Crisp and Headland: "Dublin Medical Press," 1849, vol. xx. p. 229; and Prosser James: "Med. Times and Gaz." Sept. 1859.

[2] See also Chassaignac: "Leçons sur l'Hypertrophie des Amygdales." Paris, 1854.

[3] "Bulletin de l'Acad. de Méd." 1861.

[4] Guéneau de Mussy : Op. cit.

[5] Op. cit. p. 11.

*Symptoms.*—We can often predicate the existence of enlarged tonsils as the child, with its open mouth, drooping eyelids, dull expression, and thick voice, enters the consulting room. On looking into the pharynx we can generally at once perceive the hypertrophied tonsils, and in some cases they are seen meeting each other in the middle line of the pharynx, and entirely concealing from view its posterior wall. The augmentation of volume of the tonsils varies in different cases. They are often the size of a chestnut, but sometimes attain the dimensions of a bantam's egg, and in rare instances they are nearly as large as hens' eggs. The disease generally affects both tonsils, but one gland is nearly always more enlarged than the other.

Sometimes the tonsils are only slightly enlarged, but the jagged surface and dilated lacunæ present a *honeycombed* appearance, and render them very prone to inflammation.

Any considerable degree of enlargement of the tonsils gives rise to some difficulty in respiration, and there is generally noisy breathing—often snoring—during sleep. As the posterior nares and naso-pharyngeal cavity are more or less cut off from the lower part of the pharynx by the enlarged glands, respiration through the nose cannot be carried on with sufficient freedom, and the patient is consequently obliged to keep his mouth constantly open. In swallowing, he sometimes experiences the sensation of a foreign body in the throat, and occasionally there is a difficulty in opening the mouth, owing to the enlarged tonsils interfering with the movements of the angle of the jaw. In infants, enlarged tonsils often interfere with sucking.

Attention has already been called to the facial expression of children afflicted with enlarged tonsils, but it may be remarked that the peculiarities of physiognomy are the results of the profound impress which the disease exercises on the whole system. The phenomena are mainly due to the mechanical effects of the enlarged glands in obstructing respiration. The simplest and most common of the mechanical effects of enlarged tonsils is, however, the alteration which the voice undergoes. The cavities of the pharynx and nose, which form as it were the sounding-board for the vibrations set in motion by the vocal cords, have their functions in this respect more or less destroyed, the voice partakes of a nasal intonation, and the speech becomes thick and guttural. The defect in articulation is especially noticeable in the case of

children between the ages of six and twelve in whom the hypertrophy is excessive.

Interference with the sense of hearing—in some cases amounting to almost complete deafness—is a frequent concomitant of hypertrophy of the tonsils. It was at one time supposed that compression of the orifice of the Eustachian tube played the principal part in the production of "throat deafness,"[1] but the observations of the late Mr. Harvey[2] tend to prove that the increase in the size of the tonsil proceeds in the direction of the mouth, and that as the tonsil enlarges the Eustachian aperture becomes more patent than in the normal state. He therefore attributed this form of cophosis to chronic swelling and congestion of the mucous membrane of the Eustachian tube, and recent[3] researches have shown that one of its chief causes is pressure of Luschka's tonsil on the posterior lip of the Eustachian orifice.

Of all the evil results attendant on hypertrophy of the tonsils, those due to interference of the diseased masses with free respiration are the most serious. The partial occlusion of the nasal channel posteriorly by the enlarged tonsils, obliging the patient to keep the mouth almost constantly open, renders him unusually exposed to all the external influences which produce inflammatory affections of the respiratory tract, whilst the persistent obstruction to respiration leads to serious changes in the thoracic parietes. In 1828, Dupuytren[4] called attention to the frequency with which deformity of the walls of the chest was found associated with hypertrophy of the tonsils, without, however, signalling anything besides a mere coincidence between the two phenomena. He described the modifications in the shape of the thorax as consisting in narrowing of the anterior superficies, bulging out of the back, and flattening on both sides, but these changes are more characteristic of rhachitic disease. Subsequently, this subject was still further investigated by several observers, but principally by Mason Warren,[5] Shaw,[6]

[1] Chassaignac: Op. cit. p. 37, et seq.

[2] "The Ear in Health and Disease," London, 1865, p. 162; and "The Enlarged Tonsil," &c., London, 1850, p. 21, et seq.

[3] Michel: "Krankheiten der Nasenhöhle," &c. Berlin, 1876, p. 102, et seq.

[4] "Répert. d'Anat. et de Physiol." 1828, t. v.

[5] "Philadelphia Medical Examiner," May, 1838.

[6] "Medical Gazette," October 29, 1841, p. 187, et seq.

Robert,[1] and Lambron.[2] Mr. Shaw called attention to the frequent association of enlarged tonsils and the so-called "pigeon-breast," whilst to Lambron is due the credit of having most accurately noted the various morbid changes, and of having explained their causation in a thoroughly rational manner. According to Lambron, the characteristic malformation of the thoracic cavity met with in cases of enlarged tonsils is a circular depression of the walls of the chest at about the junction of the lower and middle third. The thorax seems as if it had been confined by an unyielding ring which, while contracting its growth in this situation, gives an appearance of abnormal bulging to the upper part of the cavity. This circular depression corresponds with the attachment of the diaphragm internally to the osseous framework of the chest, and is evidently due to the constant energetic contractions of that muscle to overcome the obstacle to free respiration. In childhood the bones yield easily to such influences, and any one who has witnessed the difficulty of breathing which occurs, especially during sleep, where there is any considerable hypertrophy of the tonsils, will readily understand how pernicious may be its effects on the respiratory apparatus. In addition to the organic alterations in the bones of the chest, other evils are brought about, and Chassaignac[3] well observes that although increased efforts of the diaphragm, to a certain extent, neutralize the impediment to respiration, there are frequent intervals when the powers of the muscle become temporarily exhausted, and the oxygenation of the blood is very incompletely performed. The vital forces are in consequence very much lowered, the patient lives in a state of permanent ill-health, and easily succumbs to any acute attack of disease, particularly if affecting the respiratory organs.

Besides the various phenomena attendant on hypertrophied tonsils, as detailed above, Chassaignac[4] mentions several cases to illustrate the evil effects of the disease on the brain, the digestive organs, and on the senses of sight, taste, and smell. He thinks that the local pressure of the enlarged glands diminishes the supply of blood to the brain, and impedes its return; whilst the digestive organs suffer when there is difficulty of swallowing, and also when the diseased tonsils discharge putrid matters which find

[1] "Bulletin Général de Thérapie Medicale," &c. 1843.
[2] Loc. cit. [3] Op. cit. p. 30. [4] Ibid.

their way into the stomach. With respect to smell and taste, I have often observed that these senses are more or less defective in the subjects of enlarged tonsils, if the condition has existed for any length of time. As regards sight, however, I have not met with any cases in which I could trace any clear connection between affections of the eye or modifications of vision and enlarged tonsils.

*Pathology.*—The diseased condition is a true hypertrophy, a veritable hyperplasia, in which the volume of the glands is not only increased, but increased by a multiplication of

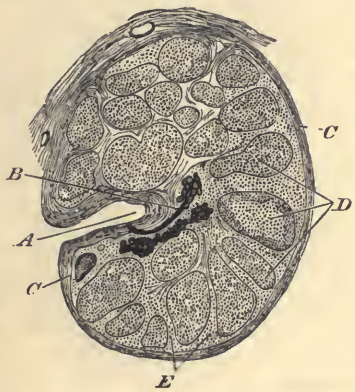


FIG. 9.—SECTION OF THE HEALTHY TONSIL.

A, Hilus; B, Mucous gland; C, Epithelial covering; D, Lymphatic follicles; E, Stroma.

all their constituent tissues and follicles.[1] According to Chassaignac[2] the limit of weight of the enucleated tonsil in the cases which he examined was from three grammes two centigrammes to seven grammes fifty centigrammes. The epithelium does not usually show much alteration, but the papillæ beneath are often more numerous and less elevated than in the normal state. On making a section of an enlarged tonsil, in some instances the structures will be found to cut with a creaking noise, owing to thickening and induration of the connective tissue, whilst at other times the substance of the diseased gland is found to be characterized by softness and friability. The colour of the cut surface

[1] Virchow: "Krankhaften Geschwülste," vol. ii. p. 612.
[2] Op. cit. p. 13.

may vary from a dusky-red to a dirty-yellow hue. The lacunæ are seen to be dilated, and to have their walls thickened; whilst their cavities are filled with a viscid mucus, which in some cases becomes consolidated into matter of a caseous or even calcareous consistence. Around the lacunæ are congregated the follicles of the tonsil, which are always

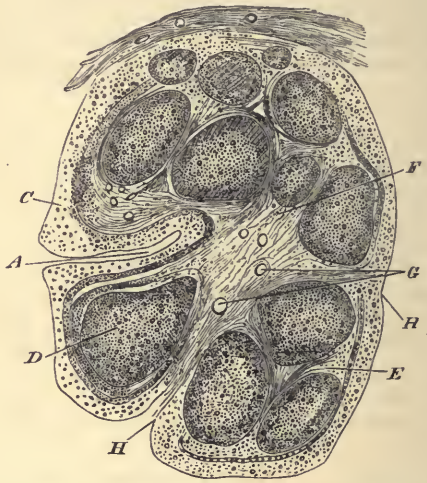


FIG. 10.—SECTION OF THE ENLARGED TONSIL.

A, Hilus; C, Epithelial covering; D, Lymphatic follicles; E, Stroma; F, Increased connective tissue of stroma; G, Enlarged vessels; H, Slight interruption of the epithelial covering.

This woodcut is a slightly schematic illustration made by Dr. Stephen Mackenzie from sections of a diseased tonsil removed by the author, and shows the appearances usually observed on microscopic examination. The laminated epithelial covering is a good deal thickened. At H the epithelium has given way, probably owing to suppuration and rupture of some subjacent lymphatic follicles. Beneath the epithelium the mucosa is seen to be increased by the extra development of lymphatic cells, some of which in places insinuate themselves between the epithelial cells. The lymphatic follicles are enlarged, and the distinction between the follicles and surrounding lymphatic tissue in places obscure. No distinct caseation is shown in the drawing—none having been present in the case from which it was made. The lymphoid cells of the follicles are packed closely together, and some of the cells are large and pale. In many cases the follicles are much more numerous than in the illustration, and are arranged in rows perpendicular to the surface. The connective tissue is largely increased, and contains much larger vessels than seen in the healthy condition. The acinous mucous glands naturally present in the tonsil have disappeared.

increased in size and generally in number. The capsule[1] of the tonsil is also generally thickened and indurated, and the

[1] Chassaignac: Op. cit. p. 7.

lymphatic glands of the jaw are in many cases considerably enlarged.[1]

*Diagnosis.*—But little need be said on this point. It is only necessary to examine the pharynx in order to perceive the increased size, and often the diseased surface, of the tonsils. In some cases the tonsils, though actually but slightly increased in dimension, seem to have undergone great enlargement, owing to their being rotated forwards and inwards towards the median line.[2] In this way they present their internal surfaces anteriorly and, stretching across the front of the pharynx, closely approach each other. In some persons this movement, which is semi-involuntary, occurs to a much greater degree than in others, and in such cases the peculiarity is at once seen if a disposition to retching is artificially produced. If, however, the patient be told to open his mouth and inspire deeply, the normal position of the parts will be generally retained. At other times the tonsils, although much hypertrophied, are yet almost hidden behind the pillars of the fauces.[3] This condition can easily be diagnosed by placing the first finger of one hand on the internal surface of the tonsil, and that of the other hand externally just behind the angle of the jaw, when an accurate estimate of the proportions of the gland can at once be arrived at. A little familiarity with the usual conformation of the pharynx will prevent either of these appearances leading the observer into error. It may be remarked that retro-pharyngeal abscess has sometimes been mistaken for enlargement of the tonsils.

*Prognosis.*—Hypertrophy of the tonsils occasionally exists in the adult—and even in children—without giving rise to any inconvenience or evil effects. Such cases are, however, quite exceptional, and in early life especially the disease is one which almost always requires immediate attention. The enlarged tonsils sometimes spontaneously regain their normal dimensions about the age of puberty, but by that time the morbid condition may have seriously impaired the general health of the patient. When the hypertrophy takes place in adult life, it is seldom productive of any evil consequences, except in so far as it occasions local inconvenience. Should the bodily powers, however, be feeble, the constitution is likely to suffer, and in

[1] Griesinger: "Archiv. f. Phys. Heilkunde," vol. iv. p. 515.
[2] Chassaignac: Op. cit. p. 8.
[3] Guersant: "Hypertrophie des Amygdales." Paris, 1864.

any case the disease becomes important when, as is often the case, the gland is frequently attacked by slight inflammation. It is well, however, to remember that after the age of thirty a progressive diminution in the size of the tonsils, and a gradual cessation of all the troublesome symptoms, are almost certain to take place.

*Treatment.*—The various measures for reducing hypertrophy of the tonsils may be conveniently divided into *local*, *constitutional*, and *operative*.

*Local treatment* consists in the application of remedies to the tonsils in order to effect a diminution of their volume. When the enlargement is slight, and in a great measure due to irregular thickening of the mucous membrane covering the tonsils, and to dilatation of the lacunæ, producing the *honeycombed* appearance already described, astringent preparations are often productive of decided benefit; but such agents never cause any considerable reduction of the gland structure. The most effective astringents in such cases are perchloride of iron in solution, and alum or tannin in powder. A solution of perchloride of iron (ʒj to ʒij ad ʒj) may be painted over the tonsils once or even twice daily with a brush. Finely powdered alum or tannin can be effectually applied by means of the pharyngeal spatula. The extremity of the spatula should be slightly moistened in order that a coating of the powder may adhere to it, and the remedy should then be well rubbed into the surface of the tonsil. This plan answers better than applying the powder with an insufflator. The application ought not to be made more than once a day. Tincture of iodine painted over the tonsils has often been recommended, but has little effect in resolving the hypertrophy. The solid stick of lunar caustic has also been loudly vaunted, but it seldom materially lessens the bulk, or improves the pathological condition, of the glands. When the glands are really hypertrophied the remedy must be of a destructive character, and escharotics must be used. In my hands the London paste (Throat Hosp. Ph.) has succeeded far beyond any other remedies of this kind, and has indeed, in many instances, precluded the necessity for excision of diseased tonsils. Its method of application has already been described (page 36). The application may be repeated once or twice a week, according to circumstances, on different parts of the surface of the tonsil. On each occasion the result is a slough, and a large amount of the diseased mass may thus be destroyed in succes-

sive layers, until the glands have been reduced to a normal volume, or at least to such a size as to cease to give rise to troublesome symptoms. It must be confessed, however, that the treatment is tedious, and that the guillotine affords a quicker method of effecting a complete cure. I have treated a few cases successfully by parenchymatous injections of dilute acetic acid (B.P.) with a curved syringe, but the treatment is slightly painful. From ten to fifteen injections were used in each case. Dr. Solis Cohen[1] has reduced the enlarged glands by electrolysis—from ten to twenty operations having been required in each case.

*Constitutional Treatment.*—Whilst any of the measures detailed above are being carried out, internal remedies should be administered in order to improve the general health, or to combat the morbid diathesis which may be present. With this view the diet should be as nutritious as possible, and the patient should be treated with special drugs or general tonics, such as iodide of potassium, cod-liver oil, and phosphate of iron, &c., according to the circumstances of the case. Lambron[2] speaks highly of the effects of sulphurous waters (Bagnères-de-Luchon). The patient drinks and bathes in the waters, has them applied directly to the pharynx and neck by means of a douche used daily for five to fifteen minutes, and employs spray inhalations. Dr. Lambron states that the general health is always much improved by a course of these mineral waters, whilst in very many cases the tonsillar hypertrophy undergoes resolution, and the glands are almost reduced to their normal size.

*Operative treatment* consists in the removal of a portion of the tonsils by abscission.

[1] "Diseases of the Throat." New York, 1872, p. 132.
[2] Op. cit.

*Extirpation of the Tonsils.*—This operation must have been commonly practised at a very early period, for although the first clear mention of it is made by Celsus[1]—A.D. 10—he speaks of excising the tonsils with such familiarity that it was evidently considered a very ordinary and trifling procedure. He observes:—"Tonsils which remain indurated after inflammation, if covered by a thin membrane, should be loosened by working the finger round them, and then torn out; but when this is not practicable they should be seized by a hook and excised with a scalpel." Ætius[2]—A.D. 490—the next writer who gives an account of the operation, speaks of it in much more cautious terms. "The portion," he remarks, "which projects—*i.e.*,

[1] "De Medicina," cap. vii. sect. 12.
[2] "Βιβλία Ἰατρικὰ Ἑκκαίδεκα." Venice, 1534, cap. ii. sect. 36.

about one-half of the enlarged gland—may be removed. Those who extirpate the entire tonsil remove at the same time structures which are perfectly healthy, and in this way give rise to serious hæmorrhage." Paulus Ægineta [1]—A.D. 750—instructs us as to excision of the tonsils very precisely. He does not approve of operating on them when inflamed, and describes them as being most fit for removal when they are "white, contracted, and have a narrow base." The head of the patient is held, and his tongue pressed down with a spatula by assistants, and, the tonsil being seized and drawn outwards by a tenaculum, is "cut out by the root." Albucasis [2]—A.D. 1120—evidently takes Paul of Ægina for his preceptor, and gives almost the same directions for performing the operation. He is, however, more cautious in his advice, dreads hæmorrhage, and fears to excise the tonsils unless when they are "round, whitish, and have a narrow base." Subsequently to this period the operation appears to have fallen into disuse, and having become almost obsolete and traditionary, succeeding writers either omit all mention of it, or approach the subject with such timidity as to show that they had had no personal experience. Thus even the zealous and indefatigable Ambroise Paré [3]—1509—counsels tracheotomy when serious enlargement of the tonsils exists, and gives a hint also as to ligaturing the hypertrophied glands, but makes no remark as to their excision. Fabricius, of Acquapendente [4]—1540—makes some comments on the instructions of Celsus and Paul of Ægina, and comes to the following puerile conclusion:—"Whence we can perceive that this surgical procedure is neither easy nor altogether safe. Wishing that all violence should be avoided in this operation, we should, therefore, advise a trial to be first made to loosen the tonsil from the surrounding structures with a vectis, and then, having laid hold of it with a very slender vulsellum, to pull it outwards in order that the gland may come away almost of its own accord." Guillemeau,[5] the pupil of Ambroise Paré, advocates a bolder surgical treatment of the tonsils than did his master, and does not resort to tracheotomy unless the patient's mouth cannot be opened. According to circumstances, he ligatured or cut away the diseased masses, and he is opposed to the removal of the entire tonsil. In 1637 Severini,[6] during an epidemic at Naples, the principal symptom of which consisted in great swelling of the tonsils, removed large portions of the glands, when sessile, by caustics, and, when pediculated, by means of a hook and a kind of a semi-circular knife. Nevertheless, for a whole century afterwards excision of the tonsils was almost entirely discountenanced, although some few surgeons occasionally had recourse to the ligature. Dionis [7]—1672—opposes altogether the removal of the tonsils, whether by excision, evulsion, or ligature, and states that the glands have a physiological importance which completely precludes the advisability of wholly or partially taking them away. Juncker [8]—1680; Heister [9]—1683; and Sharp [10]—1688—a

[1] New Sydenham Society's "Translations," vol. ii. p. 297.
[2] "Al-Tasriff." Oxford, 1778, cap. ii. sect. 36.
[3] "Œuvres Complétes," Edit. Malgaigne, Paris, 1840, t. i. p. 383.
[4] "Opera Chirurgica," Lugduni Batavorum, 1723, col. 461-2.
[5] "Les Œuvres de Chirurgie de Jacques Guillemeau," Paris, 1612, p. 688.
[6] Saint-Germain, "Dict. de Méd. et de Chirurg. Prat." Paris, 1835, vol. ii. p. 156.
[7] "Cours d'Opérations de Chirurgie." Paris, 1714, p. 532.
[8] "Conspectus Chirurgiæ tam Medicæ quam Instrumentalis." Halæ, 1721, p. 661.
[9] "A General System of Surgery." London, 1763, vol. ii. p. 44.
[10] "Surgical Operations." London, 1761, p. 189, 8th edition.

pupil of Cheselden—all fear to excise the tonsils, and condemn the operation, contenting themselves with feeble attempts to remove portions of the glands by ligature or cautery. The opinion of Heister is worth quoting, as his surgical treatise was, perhaps, the most popular text-book during the first half of the last century. "This operation," he observes, "is not only too severe and cruel, but also too difficult in the performance, to come into the practice of the moderns, because of the obscure situation of the tonsils. After 1740, however, the operation by means of the tenaculum and bistoury was again much practised, and the credit of the revival is principally due to Meseati[1] and Wiseman.[2] The practice of the latter surgeon was first to ligature the tonsil, and then to cut off the projecting portion. In 1757 Caqué[3] commenced to excise the tonsils at the Hôtel-Dieu of Rheims, and proved indisputably that the great dread which existed of hæmorrhage was quite chimerical, and that the resulting wound readily healed in a short time. From this date excision of the tonsils became one of the recognized operations of surgery, and practitioners began to improve the instruments, and invent new methods for performing it. It is unnecessary to describe here all the various hooks, forceps, bistouries, &c., which were devised during the last century for the excision of the tonsils, as almost every eminent surgeon made some modification of the instruments used for the purpose by his predecessors or contemporaries. The method most generally in favour was, perhaps, that of Louis,[4] who employed a blunt-pointed bistoury or pair of scissors, the blade or blades being sometimes preferred curved and sometimes straight. The patient was placed with his face towards the light, and directed to open his mouth widely; an assistant then pressed down the tongue with his finger, or with a spatula, whilst the surgeon seized the tonsil with a vulsellum, and, drawing it as much as possible towards the median line, cut off the superfluous portion on a level with the pillars of the fauces. After a time the scissors gave way to the bistoury, and many surgeons still operate with the knife and forceps.

A description of the tonsillotome or guillotine, and the mode of using it, will be found under "Pharyngeal Instruments" (p. 10).

As regards the respective merits of operation by the tonsillotome, or by the bistoury and forceps, it is obvious that the former instrument ought to be used in all but exceptional cases. When the tonsils are only slightly and irregularly enlarged, or have calculi impacted in their substance, the bistoury and forceps may perhaps be more manageable; but in all ordinary cases the tonsillotome must be considered to be the instrument which modern surgical invention has succeeded in perfecting for its purpose.

In adults the tonsils occasionally attain such a magnitude

[1] "Mém. de l'Acad. de Chir." t. v. "Sur la rescission des amygdales tuméfiées."
[2] "Eight Chirurgical Treatises." London, 1734, vol. ii. p. 30, 6th edition.
[3] "Amygdalotomie," 1757.
[4] "Mém. de l'Acad. Roy. de Chir." 1774, t. viii. p. 423, "Sur la rescission des Amygdales."

that they cannot be encircled by the ring of the largest tonsillotome. This extreme hypertrophy generally takes place on one side only, and in such cases the wire *écraseur* should be employed. This operation, of course, occupies more time than when the tonsillotome is used, but is attended with little pain, and does not cause any hæmorrhage.

Some practitioners are in the habit of giving large doses of bromide of potassium for several days before excising the tonsils. I have made an extensive trial of this drug, but cannot state from my own experience that I ever saw it produce any marked anæsthesia of the fauces. In nervous patients, however, especially children, the general action of the remedy, as a nervine sedative, may, perhaps, lessen the mental apprehension and nervous shock consequent on a surgical operation. With respect to the use of anæsthetics, such as chloroform, ether, nitrous oxide gas, &c., I think that they are wholly uncalled for. The actual operation seldom occupies more than ten or fifteen seconds, and in the rare event of there being any considerable hæmorrhage it is well that the surgeon should have the active co-operation of the patient, in order to prevent the blood descending into the air-passages.

As regards hæmorrhage following excision of the tonsils I have only once met with a case in which the bleeding appeared actually to endanger life—and this was before I had discovered the means of arresting tonsillar hæmorrhage, which will be presently described. The experience of nearly all writers points to the rarity of any serious hæmorrhage, but Velpeau[1] has reported four cases in which the internal carotid artery was laid open whilst a portion of the tonsil was being cut away with a bistoury, and a few years ago Mr. McCarthy successfully tied the common carotid artery at the London Hospital in the case of a patient suffering from continuous hæmorrhage after excision of a tonsil. In the great majority of cases the bleeding soon ceases spontaneously, and it is only necessary to make the patient gargle and wash the throat with cold water for a few minutes. Occasionally a persistent oozing of blood follows the operation, but under these circumstances the tanno-gallic acid gargle of the Throat Hospital Pharmacopœia will at once arrest the hæmorrhage. Half a teaspoonful of the remedy should be slowly sipped at short intervals.

[1] Chassaignac, op. cit. p. 109.

During the act of deglutition the styptic fluid is worked into the cut surface of the tonsil, and the hæmorrhage is effectually restrained in all cases. In the worst instances the bleeding may recur again and again for a day or two, but it can at once be checked on each occasion by a prompt use of the tanno-gallic fluid. In most cases sucking ice[1] generally stops the hæmorrhage. In extreme cases, when the internal carotid has been laid open, the common carotid must be ligatured.

With respect to the method proposed by Celsus, already referred to, of tearing out enlarged tonsils by the finger, it is worthy of notice that this method has been revived and practised with success by an Italian surgeon named Borelli.[2] He describes the proceeding as easy of execution, and devoid of risk from hæmorrhage. "The index finger," he remarks, "is placed behind the summit of the gland, and by working from above downwards with the nail, and making traction, the tonsil is detached from its bed. The organ can in this way be removed entire with much more ease than with the ordinary amygdalotome. A small piece, which does not afford a sufficient purchase to the finger in order to be torn away, is generally left at the inferior part. It only requires, however, to be seized with a forceps, when it can be separated by a slight movement of torsion."

Finally, as regards the after-treatment of the operation, it may be stated that the wound usually heals spontaneously in a week or ten days. It is, therefore, only necessary to confine the patient to the house for the first few days, and to direct him to avoid all hot, hard, and irritating articles of food. Marsh-mallow lozenges (Throat Hosp. Phar.) often give great relief by forming a coating over the wounded surface, and thus protecting it to some extent from the action of the ingesta. Occasionally the wound assumes an unhealthy aspect, and becomes covered with an ashy, aphthous exudation—sometimes almost membranous. This condition is most frequently seen when the hæmorrhage has been more copious and persistent than usual. Under these circumstances if the solid nitrate of silver be lightly applied daily for two or three days, the cut surface will rapidly become a healthy ulcer. In other cases, when there is marked constitutional dyscrasia, the wound may be slow in healing, and give rise to great pain in swallowing.

[1] "Med. Times and Gazette." 1860, p. 631.
[2] "Gazzetta Med. Ital. Prov. Sard." December 30, 1861.

The discomfort can, however, always be relieved in a few days by the application of mineral astringents, such as the pigmenta of chloride of zinc or perchloride of iron (Throat Hosp. Phar.). In conclusion, the only other evil consequence of the operation that can be feared is traumatic inflammation of the pharynx. I have never met with a case of this kind, but an instance is mentioned by Liégeois[1] which resulted in œdema of the glottis and death. In the rare event of acute inflammation supervening, the practitioner should be guided by the rules which govern the treatment of traumatic pharyngitis.

## FOREIGN BODIES IN THE TONSILS.[2]

(Synonyms: Concretions. Calculi.)

*Latin Eq.*—Corpora adventitia in tonsillis.
*French Eq.*—Corps étrangers dans les amygdales.
*German Eq.*—Fremdkörper in den Tonsillen.
*Italian Eq.*—Corpi stranieri nelle tonsille.

Definition. — *Concretions and calculi imbedded in the substance of the tonsils—the result of a perverted condition of the natural secretions and of closure of the outlets of the lacunæ of the glands.*

*Etiology.*—When the tonsils are in a state of chronic inflammation, the secretions of the follicles are frequently altered in character and augmented in amount. As a consequence, the lacunæ may become blocked up by the secretion, which sometimes becomes so inspissated as to attain the hardness of a calculus.[3] In some instances calculi have been met with as large as a cherry, or even larger.[4] The presence of calculi in the tonsils has been thought by some practitioners to proceed from a gouty affection of the throat, but this supposition is entirely disproved by the analysis of tonsillar calculi, which, instead

[1] "Dict. des Sciences Médicales." Paris, 1866, vol. iv. p. 31.
[2] Foreign substances, which are arrested and detained by the tonsils, during their passage through the pharynx, are considered in the article on "Foreign Bodies in the Pharynx."
[3] Louis: "Mém. de l'Acad. de Chir." t. v. p. 463, et seq.
[4] Wagner: Ziemssen's "Cyclopædia," vol. vi. p. 970.

of being composed of urates, consist principally of phosphate and carbonate of lime.[1]

*Symptoms.*—The symptoms of this disease are not, as a rule, very prominent. A slight pricking sensation in the throat is generally complained of, and when the concretions are large and numerous, there may be dysphagia. Occasionally small calculi are discharged spontaneously from the tonsil, causing slight soreness and bleeding. In most cases the concretions predispose to attacks of quinsy, whilst they not unfrequently cause ulceration of the walls of the cavity in which they are contained, and sometimes lead to the formation of abscesses in the substance of the tonsil. In three instances I have seen prolonged suppuration determined by the presence of a calculus, and the purulent discharge only ceased on the extraction of the offending substance.

*Pathology.*—Several writers have made an analysis of tonsillar accretions, with a tolerably uniform result as to the composition of these morbid formations. They vary slightly as to the proportions of their chemical elements according to the amount of hardness to which they attain. Thus they contain phosphate and carbonate of lime, a little iron, soda, and potassa, and when soft a considerable amount of water and mucus.[2] When the lacunæ are filled by a grey, semi-fluid, or mortar-like matter, microscopic examination reveals the presence of epithelium, cholesterine, pus-corpuscles, bacteria, mould-fungi, and molecular masses or globules of chalk.[3]

*Diagnosis.*—The presence of concretions or calculi in the tonsils can only be recognized with certainty when portions of the foreign substances are either discharged spontaneously, or can be seen projecting from the lacunæ of the glands, or can be felt with the finger or pharyngeal sound.

*Treatment.*—The only satisfactory procedure consists in the removal with forceps of the concretions or calculi; or, should there be any considerable hypertrophy of the tonsils, the diseased glands must also be extirpated. In such cases the bistoury is sometimes preferable to the tonsillotome, as the blade of the latter instrument cannot always sweep round, or cut through the substance of, a large calculus.

[1] Desnos: "Dict. de Méd. et de Chir. Prat." vol. ii. p. 117. Paris, 1865.

[2] Tangier: "Anal. d'un Calcul Tonsillaire," "Journ. de Chimie Méd." 1826. Also Wurzer: "Buchner's Rep. f. d. Pharm." xxiii. 2 H.

[3] Wagner: Ziemssen's "Cyclopædia," vol. vi. p. 970.

### Parasites in the Tonsils.

As an appendix to this article it may be mentioned that some scattered instances are on record in which certain parasites, such as hydatids and trichocephali, have been met with in the tonsils. Dupuytren[1] relates the case of a young woman aged twenty-one, who for eleven months had suffered from attacks of inflammation of the tonsils. The left gland was considerably swollen, and the surgeon having diagnosed an abscess, plunged a bistoury into the tumour. As a result, nearly two ounces of watery fluid gushed out, and ultimately a large hydatid cyst, the size of a fowl's egg, was extracted. At the time the patient was affected with an abdominal tumour, and as she died soon after from an attack of erysipelas, an autopsy was made. An ovoid cyst was discovered, similar to that contained in the tonsil, but as large as a child's head, attached to the left kidney. An almost similar case, except that the patient was a man, is reported by Davaine,[2] and the same observer relates an instance in which a trichocephalus was found lodged in the left tonsil. The parasite had probably attained this situation through being expelled from the stomach during the act of vomiting.

## DILATATION OF THE PHARYNX.

(Syn.: Pharyngocele. Pharyngeal Pouch).

*Latin Eq.*—Dilatatio pharyngis.
*French Eq.*—Dilatation du pharynx.
*German Eq.*—Erweiterung des Schlundkopfs.
*Italian Eq.*—Dilatazione della faringe.

Definition.—*Enlargement of the cavity of the pharynx, either in its entire circumference, or at a particular part, so that a pouch or diverticulum is formed.*

*Etiology.*—From the nature of its surrounding and supporting structures, the pharynx rarely undergoes any considerable concentric dilatation, except at its lower part, or when the morbid condition also affects the œsophagus.[3] Occasionally, in cases of cicatricial contraction or of stricture of the gullet, the œsophagus undergoes considerable dilatation, and the lower part of the pharynx may

[1] "Leçons Orales," t. ii. p. 179.
[2] "Traité des Entozoaires," &c. Paris, 1860.
[3] See a case figured in the article on "Dilatation of the Œsophagus."

participate in this expansion. Dilatation of the pharynx, however, is more frequently confined to a limited portion of its circumference, and the stretched membrane, by projecting in one or other direction, constitutes a pouch or diverticulum. Such a protrusion really deserves the name of a *hernia*, as it consists of the mucous and sub-mucous coats only, which pass out between the fibres of the muscular tunic of the pharynx. Diverticula of this nature generally extend backwards and downwards, and make their way between the œsophagus and vertebral column, whilst occasionally they project laterally and form a tumour at the side of the neck. Rokitansky[1] conceives that diverticula sometimes result from small foreign bodies, such as cherry stones, having become lodged at some part of the pharynx. The etiology of their formation is not clear, but it seems most probable that they arise from a weakness at some part of the pharyngeal walls, which causes the membrane to yield when any unusual strain is applied. I have met with three cases in persons who had resided for many years in tropical climates, and in whom there were other symptoms of relaxation. A habit of "bolting" food is likely to disturb and vitiate the functions of the involuntary muscles of the pharynx and œsophagus, by thrusting more substance into the channel than can be carried down without stoppage; and I have ascertained that there was carelessness and hurry in eating in several of the cases of pharyngeal dilatation that have come under my notice. Finally, diverticula of the pharynx have occasionally been met with as congenital malformations, and in such cases it is possible that they may be relics of the branchial clefts.[2]

*Symptoms.* — The prominent symptom of a pharyngeal diverticulum is dysphagia, *i.e.* difficulty, unaccompanied with pain, in swallowing. Portions of food become arrested from time to time in the pouch, which thus forms a temporary solid tumour in the neck. In this way, when the diverticulum is situated between the vertebræ and the gullet, the obstruction may be so great as to close the passage. In many cases the phenomena simulate those of stricture of the œsophagus. The diverticulum, however, becomes emptied after awhile, and the occurrence is followed by a great temporary relief to the patient. Thus the symptoms vary

[1] "Pathological Anatomy" (Syd. Soc. Trans.), vol. ii. p. 12.

[2] See a case by Mayr in the "Jahrbuch z. Kinderheilkunde, iv. 3, p. 209. 1861.

considerably at different periods. The mechanism by which the contents of the pouch are voided is not well understood. The accumulation of food is ejected so that the patient thinks he is vomiting, but the process is unaccompanied by retching or nausea. In some cases the receptacle discharges its contents so gradually that a kind of rumination seems to be established. In other instances fragments of food find their way into the larynx whilst passing from the diverticulum, and give rise to severe attacks of spasm or to fits of coughing.[1] Such foreign matter may even find its way into the lower parts of the air-passages, and give rise to bronchitis or pneumonia. Sometimes it happens that the diverticulum becomes inflamed, and a cure results from adhesion of the opposite walls of the sac. Such inflammation may, however, lead to sloughing and extravasation of food into the post-pharyngeal connective tissue. Cases of pharyngeal pouch may continue for many years without causing any dangerous symptoms. I have seen several examples where the disease had been going on for twenty or thirty years, and was lately consulted by a patient in whom the symptoms had existed for fifty-one years. In none of these cases was the nutrition seriously affected. In most of them the patients had lived for a considerable period on liquid food, and the oldest of my patients had supported himself on spoon diet for twenty-seven years.

*Pathology.*—The opportunity for a post-mortem examination rarely arises, but in a case reported by Rokitansky,[2] where the symptoms had existed forty-six years, the mucous membrane of the back of the mouth was thickened, whilst that of the upper part of the larynx was œdematous. On a level with the inferior constrictor of the pharynx the mucous membrane was prolonged through the fibres of the muscle into a diverticulum about two inches in length. This pouch was enveloped with the cellular tunic of the œsophagus in such a way that the pharyngeal canal opened directly into this cavity instead of into the gullet. On trying to pass the finger or a sound into the œsophagus it was impossible to avoid diverging into the diverticulum. The walls of the pouch contained a few bands of pale, muscular fibres, whilst near its aperture the œsophagus was greatly narrowed, and the remaining extent of this canal was atrophied.

[1] See a preparation in the St. George's Hosp. Museum, Series ix. No. 14. The patient, æt. 63, died from pneumonia. He had previously suffered from repeated attacks of inflammation of the larynx.

[2] "Archives Générales de Méd." 1840, t. ix. p. 329.

*Diagnosis.*—An uniform dilatation of the pharynx can readily be ascertained by digital and laryngoscopic examination. A pharyngocele may generally be diagnosed from the history of the case. The difficulty of swallowing, the sensation of a foreign body in the throat—augmented after meals, the presence of a soft tumour on the outside of the neck, which can be dissipated by pressure, and the frequent ejection of small portions of undigested food, are all phenomena almost pathognomonic of the condition. By the use of a sound the form, size, and direction of the diverticulum can usually be determined.

*Prognosis.*—Enough has already been said to show that this affection is more frequently productive of inconvenience than of any immediate danger, although in some cases life is no doubt shortened by the condition. The chances of cure are extremely small, and little result can be expected from remedial measures, except when the pouch is at the side of the pharynx.

*Treatment.*—Where there is slight general dilatation, independent of stricture of the œsophagus, increase in the contractile power of the constrictors may occasionally be obtained by the frequent application of faradism and galvanism. In the case of a diverticulum such treatment is unavailing, but if the pouch be situated laterally, so that pressure can be brought to bear on it from the outside of the neck, the patient is enabled to empty it himself,[1] and thus avoid any serious symptoms. In such cases swallowing may be greatly facilitated by pressure with the finger on the neck opposite the diverticulum whilst eating. Under these circumstances the morbid condition may be present for an almost unlimited period without causing any ill effects beyond an inconvenience during meals. In several instances I have been able to give great relief to patients by directing them to wear a stiff stock with a pad over the seat of the diverticulum. When, however, there is danger from repeated suffocative attacks, or from inanition, it will be necessary to try and avert the peril. Should the aperture of the pouch be small, and be visible either by the unaided eye or by the laryngoscope, an attempt may be made to produce cicatricial contraction of the opening by the local application of galvanic cautery. If these measures fail, an operation similar to œsophagotomy might be undertaken, and

[1] See No. 1886 in the Royal College of Surgeons' Museum, removed from the body of a man æt. 90.

the pouch excised. This having been done, the edges of the mucous membrane would have to be carefully brought together and secured by stitches. After such a procedure, in order to avoid traction on the wound, it would be necessary to feed the patient through a tube until union had taken place.

## CANCER OF THE PHARYNX.[1]

*Latin Eq.*—Carcinoma pharyngis.
*French Eq.*—Cancer du pharynx.
*German Eq.*—Krebs des Schlundes.
*Italian Eq.*—Cancro della faringe.

DEFINITION.—*Primary malignant disease of the pharynx, generally causing death by starvation, but sometimes by hæmorrhage.*

*Etiology.*—Primary malignant disease of the pharynx may originate in the walls of that cavity, or in the tonsils. It is rare in the pharyngo-oral space, but very common in the lower portion of the canal, where it generally first attacks the posterior wall, and, passing round the sides, subsequently invades the larynx. The latter cases are not usually classified as pharyngeal affections, but are included in cancer of the œsophagus; and the remarks commonly made as to the rarity of pharyngeal cancer are based on the observation of the disease by unaided vision. The same obscurity which surrounds the etiology of cancer in other parts holds good as regards the pharynx, and heredity is the only known influence about which there is no uncertainty.

Out of 8,289 deaths from cancer recorded in the Paris registers 3 were ascribed to cancer of the tonsils and 4 to cancer of the pharynx;[2] but these statistics could only have had reference to cancer in the pharyngo-oral cavity.

*Symptoms.*—When the disease is in the pharyngo-oral space the tumour can always be seen, and can also be felt with the finger. The voice becomes thick, articulation indistinct, and

[1] In this article, the disease is considered in so far as it relates to the pharyngo-oral and pharyngo-laryngeal cavities. Cancer of the *pharyngo-nasal* cavity will be considered in connection with diseases of the nose.

[2] Walshe: "The Nature and Treatment of Cancer." 1846, pp. 265, 267.

the expectoration fetid. The affection causes constant pain, which is greatly increased on attempted deglutition. The pain becomes greater when ulceration commences, and often darts into the ear. As the disease advances the respiration becomes obstructed, and great inconvenience is often experienced from the posterior nares being blocked up. When the cancer is situated in the pharyngo-laryngeal cavity, the symptoms, course, and termination of the affection are almost identical with the phenomena attendant on malignant disease of the œsophagus, and the disease generally runs a slower course than when it occurs in the pharyngo-oral space. In the lower situation there is dysphagia but often no odynphagia. As a consequence, the patient takes more food, and lives longer, and more time is allowed for the development of the characteristic cancerous cachexia. The constant expectoration of a frothy mucus is a characteristic symptom. The disease sometimes leads to perforation of a vessel, from which fatal hæmorrhage may ensue.

*Pathology.*—When the disease is situated in the *pharyngo-oral* cavity, it is usually of the scirrhus variety, presenting, as Delpech[1] remarks, a considerable resemblance to malignant disease of the rectum. Physically the first sign of scirrhus of the upper part of the pharynx is a hard, imperfectly circumscribed mass, occupying a variable extent of the sub-mucous tissue of the tube, and invested by the mucous membrane, which in the early stages retains to all appearance its normal character. At this period a hard elevation can usually be felt, whilst pressure does not, as a rule, occasion any pain. As the malady progresses the induration gradually extends over the greater part of the pharynx, and may involve the veil of the palate and the orifices of the posterior nares. Ulceration next commences, and extends over the whole of the affected part, presenting a reddish or greenish-white surface covered with fetid exudations, and, later, numerous fungous elevations arise from the surface of the ulcer. Tumefaction of the cervical glands about the angle of the jaw generally takes place at an early period. I have seen many cases of cancer in which the upper part of the pharynx and the epiglottis were both affected, in which it was impossible to determine in which part the disease originated. A case of this sort was

[1] "Dict. des Sc. Méd." Paris, 1812, vol. iii. p. 611.

exhibited by me at the Pathological Society some years ago,[1] and a typical example has been described and figured by Mr. A. T. Norton.[2]

Cancer of the *pharyngo-laryngeal cavity* is a very common disease. It is usually of an epitheliomatous character, though scirrhus occasionally occurs. It commonly commences just below the level of the arytenoid cartilages. In the earlier stages, pale greyish-white slough-like vegetations can be seen with the laryngoscope at the lower part of the pharynx, surrounded by a zone of bright red, swollen, mucous membrane. Sometimes the disease commences in the thyroid fossa, but in nearly all cases, whether originating at the back or the sides of the pharynx, it extends round the cavity and reaches the air-passage. As the disease progresses, considerable tumefaction of all the tissues takes place, but the cervical glands are not generally enlarged.

*Diagnosis.*—The diagnosis of cancer of the pharynx seldom presents any difficulty, although cases are on record in which syphilitic condylomata[3] and gummata[4] were mistaken for malignant disease. The use of iodide of mercury and iodide of potassium respectively cured the cases referred to, and demonstrated the error of diagnosis. A fibroma may also be mistaken for encysted cancer, but its peduncle generally serves to distinguish it, and it shows no disposition to ulceration.

*Prognosis.*—The disease must necessarily end in death, and the only doubt which can exist in the prognosis relates to the question as to how soon the malady may be expected to prove fatal. The duration of life is generally much shorter when both respiration and deglutition are affected than when swallowing alone is impaired.

*Treatment.*—Palliative measures alone can be adopted. Should respiration be dangerously incommoded, tracheotomy will often obtain a prolongation of life, whilst inability to swallow must be met by the use of the œsophageal tube, or by the administration of nutritive enemata.[5] Finally, an attempt may be made to prolong life, by resorting to

[1] "Trans. Path. Soc." vol. xix. p. 71.

[2] Ibid. vol. xvi. p. 53.

[3] Fournier: "Plaques muqueuses hypertroph. des Amygdales;" M. Fano: "Thèse d'Agrégation." 1857.

[4] Lancereaux: "Treatise on Syphilis" (New Syd. Soc.). 1868, vol. i. p. 310.

[5] See the article on "Cancer of the Œsophagus," in this work.

œsophagotomy, hereafter described. Scirrhus, in the lower part of the pharynx, is the form of cancer most likely to furnish a suitable case for such an operation.

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## Cancer of the Tonsils.

This is a rare disease, but cases have been reported by Velpeau,[1] Maisonneuve,[2] Lobstein,[3] Lennox Browne,[4] &c. Most of the reported instances belonged to the encephaloid variety, the disease being in some cases primary and in others due to extension from adjacent parts. I have met with seven cases of cancer of the tonsils, five of which were encephaloid, and two scirrhous. The following short summary shows the sex and ages of the patients :—

| Encephaloid. | | | Scirrhous. | |
|---|---|---|---|---|
| Males. | | Female. | Male. | Female. |
| Æt. 22<br>,, 37<br>,, 58<br>,, 67 | 4 | Æt. 43.. 1 | Æt. 47.. 1 | Æt. 34.. 1 |

The average duration of life after the symptoms appeared was seventeen months, the maximum having been twenty-five, and the minimum nine months. One or both tonsils may be the seat of the malady, which commences in the form of a tumour situate in the substance of the gland, and at a more advanced period presents an ulcer which there is little difficulty in recognizing as cancerous.[5] Chronic induration and hypertrophy of the tonsils may sometimes simulate malignant disease in the early stages, but the history and progress of the case, together with the age of the patient, afford a definite clue to the nature of the malady. Hypertrophy of the tonsils generally commences early in life, and is rarely met with after the fortieth year. Cancer, on the other hand, is seldom met with before the adult period, whilst all the symptoms become aggravated with comparative rapidity, and a fatal termination quickly ensues. When the cancer is confined to a portion of one or both tonsils, these organs

[1] Liégeois : "Dict. des Sc. Méd." Paris, 1864, vol. iv. p. 26.
[2] "Bulletin de la Société de Chirurg."—"Cancer des Amygdales." 1859.
[3] "Anatomie Pathologique." 1829, vol. i. p. 429.
[4] "The Throat and its Diseases." London, 1878.
[5] Lébert: "Traité des Mal. Canecr." 1851, p. 422.

may be excised, with the occasional result of affording the patient a few months respite.

Cases which clinically are considered cancer, on *post-mortem* examination are often found microscopically to be of the *lymphomatous* or *lympho-sarcomatous* character. A remarkable instance of this kind has been reported by Dr. Moxon,[1] in which the left tonsil, the lymphatic glands, and the spleen were all the subjects of a brain-like growth. These tumours consisted for the most part of cells, kept together by a network of fine fibres. The cells were larger than lymph-cells, and the interior of each was filled with a large nucleus and many nucleoli. I have met with a somewhat similar instance in a patient aged fifty-seven, in whom both tonsils and the lymphatic glands of both sides were affected with similar cellular growths. In this case the development of the tumour was checked for a long time by subcutaneous injections of acetic acid. I have also seen two cases of simple lymphoma of one tonsil, in patients aged respectively twenty-seven and thirty-two. In each case life was prolonged by repeated removals of diseased structure, but the affection ultimately proved fatal from dysphagia and consequent marasmus. In my three cases of lymphomatous disease of the tonsils the patients were men.

## NON-MALIGNANT TUMOURS OF THE PHARYNX.

*Latin Eq.*—Tumores non maligni pharyngis.
*French Eq.*—Tumeurs non malignes du pharynx. Tumeurs bénignes du pharynx.
*German Eq.*—Gutartige Geschwülste des Schlundes.
*Italian Eq.*—Tumori non maligni della faringe.

Various formations of a non-malignant nature are occasionally met with in the pharynx. I have treated many cases of papilloma, varying in size from a pea to a small grape, situated on the pillars of the fauces, tonsils, or posterior wall of the pharynx. Luschka,[2] Sommerbrodt,[3] and others have also reported cases of pharyngeal papilloma. Large growths of fibrous structure and fatty tumours have also been met with in this region. Barnard Holt[4] has

[1] "Trans. Path. Soc." vol. xx. p. 369.
[2] Virchow's "Archiv." vol. l. p. 161.
[3] Ibid. vol. li. p. 136.
[4] "Trans. Path. Soc." vol. v. p. 123.

recorded a case in which a fatty tumour springing from the left side of the epiglottis and pharynx hung down into the œsophagus for nine inches. The patient was eighty years of age, and was nearly suffocated on one occasion by the mass being propelled upwards, and occluding the larynx during the act of vomiting. The growth was not removed during life, and the man subsequently died suddenly while smoking. Two preparations of pedunculated tumours removed from the pharynx during life are contained in the Royal College of Surgeons' Museum.[1] The first of these is a lobulated mass, about two inches long and half-an-inch in diameter, and resembles a mucous polypus of the nose. It was attached by a very slender pedicle, not thicker than ordinary twine, just behind the tonsil. In the other case the diameter of the growth is considerably greater. The tumour is of irregular spherical shape, and appears to be of a fibroid nature. Its surface is covered by mucous membrane, but is ulcerated at several points. The mode of attachment is not quite clear, but the tumour seems to have been attached by a stout, strong pedicle to the wall of the pharynx. Voltolini[2] reports the case of a small fibroid growth, about half the size of a pigeon's egg, springing from the posterior wall of the pharynx, whilst Fischer[3] describes a tumour, apparently sarcomatous, which extended from the base of the skull to the cricoid cartilage. According to Busch[4] such tumours may take their origin from the mucous membrane, from the connective tissue posterior to it, from lymphatic glands, or from the periosteum covering the vertebral column. Finally, it may be remarked that growths originating in the naso-pharyngeal cavity or posterior nares often descend into the pharynx proper.

*Symptoms, &c.* — The main symptoms produced by pharyngeal growths are those due to interference by the morbid mass with deglutition or respiration, and they vary with the size and position of the tumour. Small excrescences on the fauces or tonsils cause little inconvenience beyond an occasional sensation of a lump in the throat in swallowing. In some cases the tumour may give rise to troublesome cough, if lying in contact with the larynx or epiglottis. The diagnosis of growths in the pharynx can generally be made without

[1] Nos. 1090 and 1091.
[2] "Galvanokaustik," p. 226.
[3] "Wiener Mediz. Wochenschrift." 1865, No. 61.
[4] "Berliner Charité-Annalen." 1857, vol. viii. p. 1.

difficulty on examination with the unaided eye or by the aid of the laryngeal mirror.

*Treatment.*—Small growths, such as papillomata, may be torn off by strong forceps, or can be quickly destroyed by the application of London Paste (Throat Hosp. Phar.). Larger formations, if pedunculated, may be removed by forceps, by galvanic cautery, or by the écraseur, or the base may be encircled by a ligature, and the tumour then be cut off with the knife. In the case of growths of such a size as to fill up a great part of the pharynx, care must be exercised in their removal. Thus we see that in Holt's case the mere displacement of the tumour upwards was sufficient to produce suffocation by occluding the larynx. Should the attachment of the growth be extensive and vascular, excision is attended with the risk of asphyxia from hæmorrhage. Under these circumstances it has been recommended first to perform tracheotomy, and as soon as the patient is able to breathe freely through the tube to remove the morbid mass in the pharynx.[1]

## SYPHILIS OF THE PHARYNX.

*Latin Eq.*—Syphilis pharyngis.
*French Eq.*—Angine syphilitique.
*German Eq.*—Syphilis des Schlundkopfs.
*Italian Eq.*—Angina sifilitica.

DEFINITION.—*Syphilis attacking the pharynx and presenting the phenomena met with in the three stages of that disease when affecting mucous surfaces.*

*Etiology.*—Syphilis of the pharynx may be the result of direct inoculation with the specific virus of the disease, but is generally a local manifestation of the malady after it has become constitutional; occasionally it is hereditary. The primary chancre, when situated in the pharynx, is almost always found on one of the tonsils, owing, no doubt, as Desnos[2] remarks, to the structure of these glands, the lacunæ of which are likely to receive and retain the syphilitic virus when introduced into the throat.[3]

[1] Durham: "Holmes' System of Surgery," vol. iv. p. 489.
[2] "Dict. de Méd. et de Chirurg. Prat." vol. ii. p. 149.
[3] The revolting practices which lead to these affections have been alluded to by Diday and Desnos, to whose writings those interested in the question are referred for further information.

Diday[1] explains that the disease should theoretically be more common among females, and my own experience tends to confirm his hypothesis. Thus, out of seven cases of primary syphilitic sores which I have met with on the tonsils, six of the patients were women. In Diday's own cases, however, the affection was divided equally between the two sexes; whilst Desnos,[2] from the examination of a mass of statistics, concludes that the primary sore is not more frequent amongst females, and explains the mode in which the disease is established in this situation in males. The rarity of chancre of the pharynx may be estimated from the fact that of 673 examples of chancres in all situations, not one was found behind the anterior pillars of the fauces; whilst of seventy-seven primary sores of the buccal region only one had its seat on the tonsil.[3] Secondary and tertiary syphilitic phenomena in the pharynx are among the commonest local manifestations of the disease, when it has become constitutional, as the result of inoculation or heredity. As Swediaur[4] observed long ago: "When the syphilitic virus is absorbed into the mass of the blood, in the majority of cases it produces its first effects on the throat." According to Martellière,[5] the causes which commonly give rise to the ordinary acute and chronic diseases of the pharynx determine the specific disease to attack that part in syphilitic persons. With respect to the frequency with which the throat becomes the seat of lesion in constitutional syphilis, the same authority states that, on examining seventy-two patients affected with the malady, he found only twenty-one in whom the pharynx did not present some characteristic alteration.[6]

*Symptoms.*—The symptoms of syphilis of the pharynx vary, subjectively and objectively, according to the phase of the disease under which they appear. In primary syphilis but one local lesion can occur, viz., the product of direct inoculation—the chancre. In the secondary stage, the disease may present itself under the form of erythema or mucous tubercles (condylomata). At the third period, likewise, we may find two distinct sets of phenomena in different cases, viz., ulceration and gummata. The sequel of ulcer-

[1] "Compt. Rendus de la Soc. de Méd. de Lyon." 1861-62, t. i. p. 45.
[2] Loc. cit.
[3] Ibid.
[4] "Pharyngitis Syphilitica." 1801, t. ii. p. 147.
[5] "De l'Angine Syphilitique"—"Thèse de Paris." 1854, No. 6, p. 10.
[6] Ibid. p. 9.

ation is often contraction of the tissues of the pharynx, and narrowing of its canal and the passages leading from it.

1. Although the primary syphilitic sore is rare, Diday[1] states that he has met with eight cases, and believes that the chancre, when occurring in this situation, is generally overlooked both by patient and practitioner. I have myself seen seven cases in which no reasonable doubt could be entertained as to the nature of the disease; but in two of these the diagnosis would have been very difficult from the physical condition alone. The local appearance is generally that of an ulcer superficial, but surrounded by an elevation of slightly œdematous mucous membrane. By the touch it can be ascertained to have an indurated base, and in most cases there is very manifest swelling of the glands about the angle of the jaw. The characters of the hard chancre are not, however, always so well marked. Thus, in a patient of Diday's[2] a mere superficial erosion of the left tonsil, with slight glandular engorgement, was soon followed by the phenomena of secondary syphilis. In two other examples given by the same writer[3] a phagedænic form was assumed by the chancres, and deep, unhealthy-looking ulcers extended rapidly for several days. It is only in these cases that local or constitutional symptoms, such as pain, stiffness of the jaw, and pyrexia, are likely to attract the notice of the patient. As a rule, the chancre runs its course and heals without making much impression on the health or sensations of the person affected.

2 (*a.*) Erythema of the pharynx is a very common secondary manifestation of syphilis. Thus, out of 114 women affected constitutionally, Pillon[4] noted the affection sixty-five times.

The first symptoms of the affection are those of an ordinary sore throat, viz., dryness of the fauces, slight pain on deglutition, and occasionally a mild pyrexia. On inspecting the throat at an early period, the veil of the palate, the pillars of the fauces, and the tonsils are seen to be uniformly red. In a day or two, however, the erythema shows a decided tendency to limit itself by abrupt and well-defined margins to a certain portion of the pharynx, and to assume a symmetrical arrangement. It may affect the fauces on each side and the back of the pharynx—terminating suddenly at the anterior pillars, or it

[1] Loc. cit. [2] Ibid. [3] Ibid.
[4] "Des Exanthèmes Syphilitiques"—"Thèse de Paris." 1857, p. 19.

may cease at the centre of one tonsil, whilst extending over the whole of the opposite side. The redness never fades away gradually into the healthy tissues, but is bounded by a very distinct line of demarcation. According to Pillon,[1] a species of erythema manifests itself in the throat at a later period of secondary syphilis, which is characterized by a greyish tinge, and by granulations on the surface of the mucous membrane.

(*b.*) Mucous patches (syn: mucous tubercles, broad condylomata, *plaques muqueuses*) are present in the pharynx in a large proportion of cases of secondary syphilis. When occurring as the result of heredity, they are found in the upper part of the pharynx and on the fauces soon after birth. In adults they are generally seen on the pillars of the fauces and the veil of the palate. At first they are very slightly elevated, are of a circular or elliptic form, and nearly always symmetrically situated on each side of the throat. At a later stage they become the seat of shallow ulcerations, their surface changes to a greyish-white colour, and their edges become uneven. In six or eight weeks they generally disappear spontaneously, their former position being marked by a slightly deeper shade of the mucous membrane. While they last they cause considerable soreness of the throat, especially on deglutition. The skin manifestations associated with condylomata are usually of the nature of syphilitic papulæ, though some of the other early syphilides may be present.

3. (*a*). The ulcerations of tertiary syphilis may be divided into two varieties, viz., *superficial* and *perforating*.[2] The superficial ulcers most frequently occupy the veil of the palate, but they are sometimes seen on the pillars of the fauces and the tonsils. They extend with great rapidity, but generally attack only the superficial tissues. These ulcers are sometimes of *serpiginous* form, and are generally covered with an ichorous pus; but if this is cleared away the base is seen to be pale and smooth, with here and there some fungous granulations. The edges are irregular and jagged, and cracks or fissures sometimes proceed from them and extend for a considerable extent into the surrounding tissues. When these ulcers occur in scrofulous persons they are often very intractable, and the

[1] Loc. cit. p. 13.

[2] See Lancereaux: "Treatise on Syphilis" (New Syd. Soc.). 1868, vol. i. p. 305.

affection has been called *scrofulo-syphilitic*, but there does not seem any adequate reason for recognizing this complication as a separate disease. Perforating ulcers probably always originate in the softening of gummata. They may be situated on any part of the palate, tonsils, fauces, or back of the pharynx, and, as Lanceraux [1] says, "they gain in depth what they lose in extent." Commencing by an inflammatory redness, after a few days a spot of a dirty white colour appears at the centre of the inflamed patch, and at this point the tissues beneath become liquefied. The destructive action extends deeply, and attacks cartilage, periosteum, and even bone. Thus the palate bone, the basilar process, and the bodies of the vertebræ may become necrosed or carious. In a case [2] under my own care, where there was a deep ulcer on the posterior wall and right side of the pharynx, the patient lost more than a quart of blood, and, as she soon afterwards expectorated the transverse process of the second cervical vertebra, the hæmorrhage was believed to come from the vertebral artery. Lesions of the brain and spinal cord may also result from the ravages of syphilis on the osseous walls enclosing these nervous centres. If the skin is affected in this stage of the malady, it is generally rupia that occurs. The constitutional symptoms which accompany tertiary syphilis often denote a serious dyscrasia, and loss of appetite, emaciation, and hectic sometimes carry off the patient. Tertiary syphilitic ulceration, destroying the back of the palate, is not unfrequently the result of heredity. The ulceration breaks out fresh from time to time, and the patients, when brought for medical treatment, vary in age from three or four years to fifteen or sixteen. In later years it is not always possible to distinguish between hereditary and acquired disease. When the disease attacks the pharynx in this way, the anterior part of the mouth escapes, and the permanent central incisors are not notched.

(*b.*) Gummy tumours of various parts of the body are amongst the most characteristic phenomena of the advanced stage of constitutional syphilis. In the pharynx they are generally situated under the mucous membrane of the posterior wall, but are sometimes seen in the soft palate.[3] At first they are small and insensible, and they usually make very slow progress. As they increase the mucous membrane covering them becomes injected, and presents a violet-red

[1] Op. cit. p. 305.
[2] "Trans. Path. Soc." vol. xx. p. 283.
[3] See a case by Martellière: Op. cit. p. 58.

colour. At the same time, the glands about the angle of the jaw commence to enlarge. After existing for a variable time the gumma arrives at a stage of softening, and perforates the mucous membrane. It may either give rise to inflammatory tumefaction of the superjacent tissues, and cause a common form of tertiary ulceration, leaving no trace of the nature of its origin, or it may perforate the mucous membrane at several spots, and give slow exit to a continuous discharge of ichorous pus. When the gumma is situated in the soft palate the tissues on both sides are eaten through. Thus a fistulous communication is established between the mouth and the posterior part of the nasal cavity. The edges of such fistulæ or ulcers are generally cleanly cut, and cicatrization proceeds very slowly In these cases there is generally a disagreeable nasal voice, and in swallowing, fluids often pass up into the nose. When gummata are seated at the back of the pharynx, they sometimes originate in the periosteum of the vertebral column, and, after becoming enlarged and softened, perforate the mucous membrane.[1] The termination, however, of gummy tumours is not inevitably ulceration, for they are often reabsorbed under the influence of specific treatment.

When the ulcerative process attacks both the posterior wall of the pharynx and the soft palate, the two surfaces may be brought into apposition by the inflammatory tumefaction, and union of the opposing ulcerated surfaces sometimes takes place. Dr. Schech[2] believes that cicatricial contraction of the pharynx is not only the result of deep and extensive ulceration, but that it is frequently due to superficial erosions and denudation of the epithelium. According to that observer, it is not necessary that the ulcers or erosions should occur at the same time on the pharynx and palate, although, as a matter of fact, they are more often simultaneously present. Schech considers that the *perforation of the palate greatly favours the pharyngeal stenosis.* The loss of tissue and the consequent altered muscular relations cause a diminution of the normal tension of the soft palate, so that its mobility is impaired, and it cannot recede from the pharyngeal wall as easily as in health. The base of the uvula thus often remains in contact with the wall of the pharynx for a considerable length of time—especially when the patient is recumbent. Schech further points out that

[1] Martellière: Op. cit.

[2] "Deutsches Archiv für Klin. Medicin." 1876, xvii. Nos. 2 and 3.

the exit of air through the perforation favours adhesion by lessening and diverting the current of air which, in coughing, sneezing, and hawking, tends to break down the recently-formed adhesions in those cases where there is no opening in the palate.

The isthmus of the fauces loses its normal arch, and the velum, or whatever may remain of it, is drawn backwards by white cicatricial tissue radiating from the hard palate to the posterior wall of the pharynx. Sometimes the communication between the nose and the pharyngeal cavity is entirely cut off, whilst only a minute opening leads to the lower part of the pharynx. When the posterior nasal passage is completely occluded, the sensation in the nose is often most distressing. There is a constant feeling of dryness and stuffiness, the patient is unable to clear his throat, and suffers from loss of smell and taste. When the passage to the lower part of the pharynx is contracted, there is difficulty of swallowing and dyspnœa. It not unfrequently happens that the entrance of the larynx or orifice of the œsophagus is greatly contracted, and then the symptoms are even more severe.

*Prognosis.*—The prognosis is in most cases favourable as regards life in the early syphilitic affections of the pharynx, but serious in relation to the later manifestations. Secondary phenomena often pass away without treatment, and are not dangerous while they last. Should erythema extend to the larynx, it does not give rise to œdema of the glottis, nor to any serious swelling of the lining membrane. The same remark applies to mucous tubercles. The lesions of tertiary syphilis, however, must be attentively considered in each case before arriving at a decided prognosis. Death may result from the destructive ulceration of the coats of a large vessel; and in less serious cases, cicatricial narrowing of the air-passages, or destruction or perforation of the soft palate, may occasion permanent injury to the functions of the degluto-respiratory canals. Extensive ulcerations may lead to caries of the neighbouring bones, and induce death by establishing a persistent drain on the constitution. Should the base of the skull or vertebral column become diseased, fatal lesions of the brain or medulla spinalis may, as already remarked, be provoked. The disease may reach the larynx, and give rise to the dangers hereafter described under "Syphilis of the Larynx."

*Diagnosis.*—The diagnosis of a primary syphilitic sore

situated in the pharynx is beset with uncertainties. Not only is it a difficult and delicate matter to ascertain the history of such cases, but the local appearances are by no means pathognomonic. On this account it is generally impossible to arrive at a decided opinion until the development of constitutional phenomena, and the results of treatment combine to confirm our first suspicions. If a suspicious ulcer remain obstinate to all internal remedies and local applications (such as nitrate of silver and nitrate of mercury, &c.) for four or five weeks, we may feel almost certain as to the specific origin of the disease. If secondary syphilitic symptoms subsequently arise, still less doubt can be entertained respecting the nature of the primary ulceration. The diagnosis of syphilitic erythema of the pharynx depends principally on the simultaneous appearance of the same eruption of the skin, and on its symmetrical disposition. The pale, raised, symmetrically situated tubercles, surrounded by the brightly congested mucous membrane, can scarcely be confounded with any other condition. When these guides are not present, the history of the case, and the presence of the cicatrix of the primitive sore must be ascertained in order to arrive at a definite opinion. Tertiary ulceration is sometimes with difficulty distinguished from cancer; but in the latter disease there is generally more thickening and less destruction of tissue, and the local colouring is much brighter. An ulcerating gumma may resemble cancer for a time, but the progress of the case soon reveals its real nature. In pharyngeal phthisis the ulcers are generally very small, the dysphagia is much greater, and there is generally a very high evening temperature, which is altogether absent in syphilis.

*Treatment.*—Should a chancre of the tonsil be positively diagnosed, the surgeon will either adopt, or abstain from, mercurial treatment, according to his views with regard to the action of that drug. Emollient gargles give relief, but should the primary sore present a phagedænic character, recourse must be had to cauterization with the acid nitrate of mercury.

Secondary syphilitic affections of the pharynx do not usually require any constitutional remedies. For the last eighteen years I have seldom employed any specific treatment for adults. Under the use of local remedies the symptoms rapidly disappear, and I have rarely met with tertiary phenomena in the throat amongst those whom I previously treated for the earlier manifestations. Hence it

is probable that the non-use of mercury does not increase the risk of a further development of the disease. Should the early phenomena of constitutional syphilis, however, prove intractable, mercury may be administered. Under these circumstances, I generally give it in the form of cyanide of mercury.[1] When the early phases of syphilis are seen in newly-born children, mercury, however, acts most beneficially—especially in the form of grey powder. The resolution of erythema may be hastened by painting the part with a solution of chloride of zinc (20 grs. ad ℥j.), and mucous patches are best treated by local applications of tincture of iodine.

In the tertiary stage of syphilis our chief resource is the internal administration of iodide of potassium. Under the specific influence of this drug foul ulcerations become clean and healthy, whilst local tumefactions and gummata are resolved and reabsorbed. It is best to begin with five grains three times a day. The effect should be watched, and the dose may soon be increased with advantage to ten grains three times in the twenty-four hours. Thirty grains a-day is generally sufficient, but in some cases as much as ninety grains may be given daily with advantage. In most cases it is advisable to continue the iodide of potassium for some time after all local phenomena have disappeared, whilst on the slightest sign of any new manifestation the drug should at once be resumed. In those cases where iodide of potassium appears to produce only a temporary effect, and where recurrences are frequent, recourse may be had to the administration of small doses of cyanide of mercury. I have, however, seldom found mercury successful where iodide of potassium has failed. Locally, the treatment of tertiary syphilitic lesions of the pharynx varies according to the phenomena present. Ulcerations, if indolent, are best treated with a solution of sulphate of copper (15 grs. ad ℥j.); whilst, if spreading, the progress of the sore can generally be checked with the solid nitrate of silver or acid nitrate of mercury. When there is contraction of the passages leading from the pharynx, the canals must be dilated with bougies, forced open with dilators, or enlarged by the destructive action of galvanic cautery. Dr. Rothenburg[2] has also recommended excision of a portion of the

[1] Form. ℞ Hydrarg. Cyanid. gr. $\frac{1}{10}$; Lactis Sacch. gr. ℈. Mucilag. Acaciæ q.s. M. Ft. pil. One pill twice daily. (Throat Hosp. Phar.)

[2] "Wien. Medizin Presse." 1876, No. 33.

cicatricial tissue. The use of bougies is, perhaps, on the whole the most satisfactory method of treatment, as forcible extension or destruction of tissue is generally soon followed by fresh cicatrization. In any case, however, though great relief can be afforded to the patient as long as he remains under treatment, no cure can be predicted, as the stenosis always returns when mechanical measures are suspended.

## PHTHISIS OF THE PHARYNX.

*Latin Eq.*—Phthisis pharyngea.
*French Eq.*—Tuberculose miliaire de la gorge.
*German Eq.*—Miliartuberculose des Pharynx.
*Italian Eq.*—Tubercolosi miliare della faringe.

DEFINITION.—*Ulcerations and deposits of miliary tubercle arising in the pharynx either as primary local manifestations of constitutional phthisis or secondary to similar phenomena occurring in the lungs, larynx, or other organs of the body.*

*History.*—Within the last fifteen years there has been a growing tendency to recognize certain conditions of the pharynx accompanied by ulceration as intimately connected with the tubercular diathesis, and to differentiate the obscure phenomena sometimes met with in other affections, especially syphilis. The subject of pharyngeal phthisis had been touched on by Green,[1] Bryk,[2] Rindfleisch,[3] Wendt,[4] and Long Fox,[5] &c.; but the symptoms and pathology of the disease were first accurately described by Isambert,[6] and subsequently so thoroughly elucidated by Fränkel,[7] that but little remains to be added to our clinical knowledge of the malady.

*Etiology.* — The etiology of tubercular disease of the pharynx is the same as that of phthisis pulmonalis, viz., heredity or depression of the vital powers resulting most frequently from breathing impure air, or from insufficient nutriment, or residence in a cold, damp climate. The data

[1] "Practical Treatise on Pulmonary Tuberculosis." New York, 1864.
[2] "Wien. Med. Wochensch." 1864, xiv. Nos. 42, 44.
[3] "Lehrbuch d. path. Gewebelehre." Leipzig, 1869, p. 310.
[4] "Archiv. d. Heilkunde," xi. p. 566.
[5] "Clinical Observations on Acute Tubercle," St. George's Hosp. Reports. 1869, vol. iv.
[6] "Annal. des. Mal. de l'Oreille, et du Larynx," t. ii. p. 162.
[7] "London Med. Record." January 15 and February 15, 1877, and "Berl. Kl. Woch." Nov. 1876.

furnished by the cases observed up to this time do not, however, satisfactorily explain why the pharynx should, in certain instances, become the site of tuberculosis. Almost all of the patients were simultaneously affected with pulmonary phthisis, but by their own statements their attention had first been arrested by a progressively increasing soreness of the throat. In one case, however, reported by Isambert,[1] the subject being a female child, æt. 4½, no pulmonary symptoms could be detected, although the condition of the pharynx was typical of tubercular disease. Fränkel, as a result of his own observations, remarks that the patients seen by him "had not previously suffered from chronic affections of the pharynx, and no ground can be found for assuming that, in them, the pharynx was a *locus minoris resistentiæ*. There was no hyperplasia of the tonsils, nor any condition of the pharynx or fauces, which would entitle me to assume that a cheesy deposit was present here." He, therefore, proposes to leave the question of etiology open for the present.

*Symptoms.*—Patients suffering from pharyngeal phthisis exhibit the same succession of symptoms as those which are characteristic of ordinary consumption—the throat affection being probably only an accidental complication. The lungs, if not at first diseased, soon become affected; cough, expectoration, anorexia, hectic, and progressive debility supervene, and, finally, death ensues from exhaustion. Subjectively, the most prominent symptom of pharyngeal phthisis is the pain in the throat. The odynphagia is always great, so much so that Isambert concludes that the pain in deglutition is more severe in this than in any other affection of the part.[2] Thus, the first symptom—prior to cough, expectoration, increasing debility, &c.—which leads the patient to believe that there is anything the matter with him, is often persistent soreness of the throat. This phenomenon once established increases *pari passu* with the development of the local morbid action, and contributes much towards hastening a fatal termination. Severe stabbing pain in the ear during deglutition is also frequently complained of. According to Fränkel,[3] the fever present in tuberculosis of the pharynx, shows an unusually irregular course. It is, in fact, the fever of acute miliary tuberculosis characterized by variable evening temperatures, often up to 104° Fahr., and rising in some

[1] Loc. cit. p. 168. [2] Loc. cit. Jan. 15, p. 2. [3] Loc. cit.

instances as high as 107·06° Fahr. In one of Fränkel's cases, the curve of temperature resembled at first that seen in typhus, and afterwards that of hectic. In another, the temperature of continued fever (100·4° Fahr. to 101·2° Fahr.) was sustained, when it rose suddenly to 107·06° Fahr., and at the patient's death the thermometer registered 103·1° Fahr.

Objectively, the appearances presented by tubercular lesions of the pharynx are highly characteristic. The ulcers generally begin on the lateral walls of the pharynx, and spread thence to the roof of the mouth, and the posterior wall, as well as to the velum palati. They are of a lenticular shape, and according to O. Weber[1] bear a great resemblance to the corresponding intestinal affection. He describes them as possessing "a caseous, broken-down floor, with undermined hyperæmic edges, in which new tuberculous deposits are imbedded in various stages of development. These rapidly disintegrate, and cause necrosis of the mucous membrane lying between them." In the neighbourhood of the ulcers, grey nodules of the size of millet seeds often spring up, and ultimately break down so as to form fresh ulcerations. According to Fränkel, a disposition to hypertrophy co-exists with the destruction of tissue; and in the vicinity of the tonsils, especially, polypoid excrescences often arise from the ulcerated base. If the uvula become affected it may be enlarged to the thickness of the thumb. Tumefaction, when present, is, as Isambert remarks, not due to an ordinary œdematous condition, but to an infiltration of the tissues by a kind of gelatinous matter, which shows no tendency to escape when scarification is practised. The tendency of the affection, however, is to cause wasting of those parts which do not become the actual seat of the morbid deposit, and, in some cases, the uvula is seen to be atrophied instead of being enlarged. When ulceration attacks the epiglottis, the process of destruction often reduces that organ in a short time to a mere stump. The disease in most cases spreads to the upper part of the larynx, but as a rule does not extend further down than the ventricular bands, and does not give rise to caries of the cartilages. It is worthy of note that the post-mortem examination of the cases of pharyngeal phthisis hitherto met with, has not revealed any tubercular deposit, or ulceration of the œsophagus. In nearly every

[1] "Handb. d. Allgem. u. Spec. Chir. Pitha u. Billroth," Bd. iii. p. 360.

case of tuberculosis of the pharynx, there is enlargement of the cervical glands which, in many instances, attain the size of a walnut.

The following cases[1] serve to illustrate the disease :—

"Mrs. M. C., a married woman, æt. 29, came under my care on January 14th, 1877. Her family history was bad, her mother and only brother having died of consumption. She had always been delicate, but had two healthy children, and there was not a trace of syphilis in the mother, or either of the children. In October, 1876, she first experienced pain in swallowing, and in the November following the glands on both sides of the neck became slightly enlarged. Since October she had suffered very much from feverishness, especially at night, when she always became very thirsty. On examination she was found to be much emaciated, and there was evidence of softening of the apex of the left lung. On examining the throat, small ulcers were seen covering the palate and the right posterior pillar of the fauces, whilst the whole of the back wall of the pharynx was studded with small ulcers, varying in size from a pin's-head to a split pea. The uvula was an inch in length; on the right side of the neck one gland was as large as a pigeon's egg, and there were two other indurated glands, each about the size of a filbert nut. The epiglottis was of a pale colour, and much thickened, and presented a turban-like appearance. There were superficial ulcers occupying its right half. The ary-epiglottic fold was swollen, and presented a pyriform appearance. The right ventricular band was also thickened and ulcerated. The vocal cords were slightly thickened, and the vocal processes of both cords ulcerated. The patient remained under my care for three weeks, and during this time no marked change took place in the appearances described; three small ulcers, however, formed at the back of the tongue, and the anterior pillar (of the fauces) on the right side became ulcerated. The patient was treated with soothing inhalations (vapor benzoini and vapor conii : Throat Hospital Pharmacopœia), but they failed to relieve pain, which was very marked. She subsequently obtained great relief from the insufflation of morphia, but I heard that she died early in March.

"In November, 1876, a young lady, æt. 15, was brought to me on account of great difficulty in swallowing. Her father had been under my care some years previously for laryngeal phthisis, from which he had ultimately died; the rest of the family were healthy. This patient had enjoyed good health until the previous June, when she was accidentally immersed in a river, took cold, and lost her voice. On examination she was found to be very thin and weak; there was marked dulness at the apices of both lungs, but no evidence of softening. The whole of the pharynx was found to be studded with minute ulcerations, which, however, were most marked on its posterior wall. The uvula was greatly thickened, but very little elongated; it had a kind of brawny consistence, and was not at all œdematous. There was a fringe of small excrescences extending along the pillar of the fauces on the right side. The epiglottis was so much thickened that it was impossible to obtain a view of the larynx. In this case the evening temperature at 9·30 was for several nights 104°, and on one occasion 106°. The patient after remaining

[1] See also Dr. Gee's cases: "Barth. Hosp. Reports," vols. vii. and ix.

under my care for three weeks, and deriving considerable relief from insufflation of morphia twice a day, left England to pass the winter at Cannes, but took cold in Paris, and died in a few days."

*Pathology.*—At the necropsy of a case, reported by Fränkel,[1] ulcers were found on the lateral walls of the pharynx, on the roof of the mouth, on the nasal portion of the posterior wall of the pharynx, and on the velum, while they ceased abruptly at the commencement of the œsophagus. On microscopic examination the base of the ulcer is found to be occupied by a thick infiltration of round cells, which extend deeply into the sub-mucous tissue, even as far as the muscles, which, at these parts, present the transverse striæ less distinctly than usual. The round cells infiltrate the connective tissue of the glandulæ, but do not invade the special gland cells, which are generally in a state of fatty degeneration. The latter have a great tendency to become cheesy, and portions of cheesy matter often lie among the round cells. Isolated grey nodules are rare. In Fränkel's case, above referred to, both lungs exhibited cheesy bronchopneumonia, and an abundance of grey nodules; in the left lung there was a cavity as large as a hen's egg. There were also tubercles in the pleura, liver, and spleen, and tuberculous ulcers in the intestines. In other cases miliary tubercle was found in the choroid membrane and in the kidneys, prostate, thyroid body, &c.

*Diagnosis.*—Tuberculosis of the pharynx appears to have been generally confounded with syphilis, and to this fact the comparatively scanty amount of clinical observations is probably due. I can recall many cases which, in former years, I put down as tuberculo-syphilitic disease, but which I have no doubt now were instances of pharyngeal phthisis. Now that the disease has been so carefully described, it will be seen that there are many points of difference between the two maladies; and the observant practitioner, when once warned, will not be likely to make an error in diagnosis. The lenticular ulcers of pharyngeal phthisis, with the development of grey nodules in their neighbourhood, are extremely characteristic, and when once seen can always afterwards be readily recognized. The history of the individual cases will usually afford considerable aid to diagnosis, but it must not be forgotten that syphilis and tuberculosis may, in some instances, co-exist. Should tubercle of the choroid be present, as occurred in one of Fränkel's cases, we

[1] Loc. cit. p. 1.

are justified in assuming that there is general miliary tuberculosis. The fact that, in most cases, the pharyngeal symptoms first attract the patient's attention, is of positive value in arriving at a diagnosis.

*Prognosis.*—Tuberculosis, when manifesting itself in the pharynx runs a more rapid course than ordinary pulmonary phthisis. Thus, in all the recorded cases, death occurred in a period varying from two to six months. In none of the cases has recovery taken place, and it is probable that the pharyngeal lesions indicate such an extensive implication of all the structures of the body with tuberculosis, that the issue must necessarily be fatal. It is, however, unquestionable, that death ensues more rapidly in some cases than in others; and, for this reason, Cornil[1] and Isambert[2] have come to the conclusion that there are two varieties of pharyngeal tuberculosis, viz., an acute, and a chronic, form. As the disease almost always terminates fatally in six months, this distinction is scarcely well founded. A certain modification in our prognosis as to the duration of disease may, however, be required in different cases.

*Treatment.*—As Fränkel[3] observes, the recognition of tuberculosis of the pharynx is more creditable to our diagnostic acumen than to our therapeutic skill. But small results can be hoped for from either local or constitutional measures in such cases. The administration of cod-liver oil with a general tonic and analeptic treatment may be attended with some slight benefit, and the life of the patient may be prolonged for a short time. Almost all writers agree in discountenancing the application of astringent or caustic solutions to the ulcerated surfaces. Isambert states that he has found some advantage from the local use of glycerole of morphia. When the pain is great sedative remedies may indeed be employed as palliatives, especially in order to lessen the difficulty of swallowing. With this view insufflations of acetate of morphia, gr. $\frac{1}{4}$ to gr. $\frac{1}{2}$ once or twice daily, mixed with powdered starch, and hot soothing inhalations, can often be used with decided benefit; whilst in the worst cases recourse must also be had to nutritive enemata.

[1] "Journal des Connaissances Médicales," July, 1875, p. 193.
[2] Loc. cit. p. 164.
[3] Loc. cit. p. 48.

## TRAUMATIC PHARYNGITIS.

*Latin Eq.*—Pharyngitis traumatica.
*French Eq.*—Pharyngite traumatique.
*German Eq.*—Traumatische Schlundentzündung.
*Italian Eq.*—Faringite traumatica.

DEFINITION.—*Acute, often œdematous, inflammation of the pharynx, caused by swallowing boiling water or caustic substances, inhalation of flame, &c.*

*Etiology.*—Traumatic inflammation of the pharynx is most commonly met with in children, as the result of an attempt to drink boiling water from the spout of a kettle.[1] Swallowing corrosive liquids, either accidentally or purposely, is also a common cause of the malady. In many of such cases, however, the symptoms of the pharyngeal injury are lost in the graver phenomena arising from œdema of the glottis or severe lesion of the alimentary canal. Inflammation of the pharynx is sometimes caused by the inhalation of hot air or flame, as may occur to persons who, in the case of fire, are obliged to remain for some time in the burning building before being rescued.[2]

*Symptoms.*—Pharyngitis, as the result of any of the above causes, is accompanied by all the signs of intense inflammation, with extreme odynphagia and urgent dyspnœa. The morbid process may terminate in suppuration of the connective tissue of the neck,[3] and even in gangrene of the affected parts, but, according to Bamberger,[4] the latter issue is an extremely rare one. In many instances of this kind of injury the pharyngeal affection is almost unimportant, as forming merely a part of a deep and extensive inflammation which involves the larynx and œsophagus. With respect to corrosive poisoning, the symptoms produced by the various drugs that act in this way have a considerable resemblance, and accurate conclusions as to the particular poison can seldom be arrived at in individual cases without a chemical analysis of the contents of the stomach, &c. The

[1] See a paper on this subject by Jameson: "Dublin Quart. Journ. of Med. Sc." February, 1848; and a more recent one by Bevan: "Dublin Med. Journ." November, 1866.

[2] Solis Cohen: "Inhalation, its Therapeutics and Practice," p. 294 (Report on ten patients). Philadelphia, 1867.

[3] Stroppa: "Gazzetta Lombarda," No. 35, 1871.

[4] "Handb. d. Spec. Path. u. Therap." Bd. vi. Abth. i. p. 10.

following details may, however, be given as to the physical condition of the pharynx when acted upon by those caustic substances most commonly swallowed by accident or taken with suicidal intent.

*Sulphuric Acid.*—At first the mucous membrane of the mouth and pharynx presents a parchment-like aspect, or looks as if it had been smeared with thin arrowroot.[1] Gradually it becomes darker, and, turning to a brownish colour, separates in shreds or extensive layers.[2] When the vessels are reached, the blood is charred and resembles blacking.[3] The pain is severe, but sometimes does not come on for several hours after the poison has been swallowed.

*Nitric Acid* acts much like sulphuric acid, but the pain is almost always an immediate symptom. The mucous membrane is whitish and soon becomes of a citron colour, especially over the tonsils.

*Hydrochloric Acid.*—The mucous membrane is highly inflamed, but otherwise does not show much alteration. The surface of the tongue is generally reduced to a pulp.

*Oxalic Acid.*—The mucous membrane looks white and softened, and the small vessels are filled with blackened blood. According to Christison,[4] this acid acts as a poison independently of its corrosive properties, by causing paralysis of the heart.

*Carbolic Acid* causes the mucous membrane to become white, corrugated, and hardened.

*Caustic Potash and Soda* have very similar effects, and are not unfrequently taken in the form of *soap lees*. The mucous membrane is softened, detached, and inflamed, whilst numerous patches of a chocolate colour, almost black, are perceived. In a case seen immediately after its occurrence by Dr. Deutsch[5] the mucous membrane was of a blnish-red colour, bled on being touched, and separated quickly in shreds.

*Caustic Ammonia* acts much in the same way as potash or soda, with this difference, that the *pain* is immediate, and much greater in severity. The mucous membrane is blackened.

[1] Taylor "On Poisons," p. 178. London, 1875.

[2] In a case seen by Galtier ("Toxicologie," vol. i. p. 199), a piece of mucous membrane representing the entire lining of the gullet for a distance of nine inches was expelled at once.

[3] See a case by Gull: "Med. Gaz." 1850, vol. xlv. p. 1102.

[4] "On Poisons," p. 219.

[5] "Berliner Med. Zeitung," No. 51, 1857.

*Phosphorus* acts as a general irritant, and also causes redness of the mucous membrane of the throat. The breath has a strong odour of garlic.

*Tartar Emetic* causes soreness of the mouth and throat, with aphthous-like crusts, which are at first white, but afterwards become brown or black.

*Chloride of Zinc* (in the form of Burnett's disinfecting solution) has a strongly corrosive action on the mucous membrane of the throat, which is white and thickened, and has a strongly destructive action.

*Corrosive Sublimate* causes the mucous membrane to become white and shrivelled, and gives rise to violent throat symptoms, almost immediately on being taken.

*Arsenic* acts as a general irritant and has no corrosive action, whilst the symptoms of poisoning do not come on for some time after the dose has been taken.

*Nitrate of Silver.*—The whitish appearance of the mucous membrane, when touched by this substance, is well known. It acts as a powerful local irritant.

*Muriated Tincture of Iron* causes inflammation and swelling of the mucous membrane, and distressing urinary symptoms.

Various *saline substances*, such as *nitrate of potash*, *oxalate of potash*, *salts of lead or copper*, &c., cause inflammation in the pharynx when taken in concentrated forms, and act as powerful poisons.

*Prognosis.*—The prognosis, of course, depends on the amount of injury done to the tissues of the pharynx, larynx, and œsophagus, and on the constitutional effects produced by the poison. In slight cases where the pharynx alone has been touched by the local irritant, there is generally a good prospect of recovery, but always a risk of subsequent contraction of the pharynx. If the larynx is affected, there is danger of *immediate* death from œdema of the glottis and asphyxia. Should the œsophagus be much injured, the prospects of a fatal termination are usually more remote, but not less certain, from stricture of the gullet and marasmus.

*Treatment.*—It does not come within the scope of this article to indicate the various remedies that may be administered as antidotes, in order to neutralize the caustic effects of corrosive substances. It may be useful to mention, however, that as the action of the irritant poisons is very rapid, but little benefit can be expected from drugs which

have the property of rendering them chemically inert when in a free state.

The best treatment that can be pursued in cases of traumatic pharyngitis, is one of a purely anodyne and emollient character. Opium or morphia should be given in full doses by the mouth or hypodermically, whilst the local medication of the part is best effected by the insufflation of morphia, gr. $\frac{1}{4}$ to gr. $\frac{1}{2}$ twice or three times a day. Hot, soothing inhalations (Throat Hosp. Phar.) may also be used with advantage, but gargles are usually inadmissible, as the least movement of the fauces causes severe pain. The difficulty of feeding the patient is often great, owing to the intense odynphagia, whilst an œsophageal tube cannot be used because the softened state of the tissues renders perforation of the gullet by the instrument almost unavoidable. As soon as the sloughs have separated, and the diseased surface has assumed the character of healthy ulceration, the mucous membrane can be brought into a healthy state by the application of astringent solutions, such as the pigmenta of iron, zinc, or nitrate of silver.[1]

## ANGINÆ CAUSED BY POISONOUS DRUGS.

*Latin Eq.*—Anginæ venenis ortæ.
*French Eq.*—Angines toxiques.
*German Eq.*—Toxische Anginen.
*Italian Eq.*—Angine eccitate da droghe velenosi.

Definition.—*Morbid conditions of the pharynx caused by the action of mineral or vegetable poisons taken internally.*

1. *Mercury.*—Amongst the ill consequences sometimes arising from impregnation of the system with mercury is a species of pharyngeal inflammation characterized by redness of the mucous membrane, ulcers with a greyish coloured surface, and considerable dysphagia. At the same time the mouth and tongue are generally similarly affected, and ptyalism is usually present. This disease is most commonly met with in gilders, in persons employed in quicksilver mines, and in patients who have undergone medical treatment. The history of the case affords the best aid to diagnosis, and the local lesions generally yield after a time to the use of astringent gargles, and the internal administration of chlorate of potash—provided, of course, that the cause of the affection has been removed.

[1] Throat Hosp. Phar.

2. *Antimony.*—Tartrate of antimony, when given constantly for a few days in a concentrated form, has a very irritating effect on the mucous membrane of the pharynx. The patient complains of heat, and a painful sense of tension in the throat, whilst swallowing is rendered extremely difficult. On inspection the pharynx appears red and swollen, and often covered with aphthous ulcers. A like condition generally prevails at the same time in the mouth. Spontaneous resolution occurs in a few days after the administration of the remedy has been discontinued. The affection should be treated by gargles containing alum, sulphate of zinc, or hydrochloric acid, whilst the occurrence of the accident may be prevented by exhibiting the antimony in the form of pills.

3. *Iodide of Potassium.*—This drug exerts a special effect over the mucous membranes of the nose, conjunctivæ, and pharynx. In some persons, as is well known, a single small dose is sufficient to cause a violent coryza with incessant sneezing, and a sensation of painful tension and dryness in the throat. These symptoms are occasionally accompanied by salivation, and there is sometimes slight odynphagia. The attack resembles in a considerable degree an exacerbation of influenza, but in some cases the phenomena are almost confined to the pharynx and the salivary glands. On inspection no lesions are discernible, beyond superficial redness of the mucous membrane, and the affection subsides spontaneously on suspension or diminution of the dose of the remedy. The injection of tincture of iodine into a serous cavity is capable of producing a similar set of symptoms.

4. *Arsenic, Copper, Lead, Zinc, &c.*—The salts of all these metals, when taken as medicines, or introduced in any way in small doses into the system, have more or less power of causing hyperæmia and superficial inflammation of the mucous surfaces.

5. *Belladonna.*—This vegetable, as well as most of the other members of the natural family of Solanaceæ, is capable, when taken in an overdose, of producing painful throat symptoms. Heat in the pharynx and difficulty of swallowing are present, and there is considerable congestion of the mucous membrane. These phenomena are accompanied by dilatation of the pupils, and more or less disturbance of the intellect. The condition should be met by the use of emollient and sedative gargles, and when there are general

symptoms of intoxication by the use of stimulants—especially strong coffee.

## WOUNDS OF THE PHARYNX.

*Latin Eq.*—Vulnus pharyngis.
*French Eq.*—Plaies du pharynx.
*German Eq.*—Wunden des Schlundes.
*Italian Eq.*—Ferite della faringe.

DEFINITION.—*Solutions of continuity of the walls of the pharynx caused by violence.*

*Etiology, Symptoms, &c.*—The pharynx is chiefly liable to be wounded, in suicidal and homicidal attempts, when the throat is cut or stabbed. Wounds inflicted by drawing a knife across the throat are almost always situated below the hyoid bone, as above this level the fleshy base of the tongue intervenes so as to prevent the instrument penetrating so far as the pharyngeal cavity. The wound is often in the thyro-hyoid space, and not unfrequently the epiglottis is partially divided. Profuse hæmorrhage from some of the numerous large vessels generally occurs, and the incision gapes considerably, especially if the head is raised. Mucus, saliva, as well as blood, escape from the wound, and attempts at deglutition are followed by the extrusion of part or even the whole of the ingesta through the aperture.[1] Dysphagia is present from the first, but there is seldom any dyspnœa or alteration of voice, unless the larynx is simultaneously injured or subsequently becomes implicated by extension of inflammation. It is just possible, however, that a severed fragment of the epiglottis or one of the arytenoid cartilages may drop into the larynx, and act as a foreign body.[2] Should there be much hæmorrhage into the pharynx, the blood may pass into the air passages and speedily give rise to fatal asphyxia.

Wounds of the pharynx sometimes occur in a direction from within outwards, articles held in the mouth, such as pipe-stems, pen-holders, pencils, spoons, &c., being accidentally driven violently backwards and thrust through the walls of the cavity.[3]

[1] Moore: "The Lancet." 1864, vol. ii. p. 287.
[2] Gant: "The Science and Practice of Surgery." London, 1871, p. 828.
[3] Macleod: "Cooper's Dict. of Pract. Surg." London, 1872, vol. ii. p. 452; "Med.-Chirurg. Transact." vol. xxix. p. 38; and Durham: "Holmes' System of Surgery," vol. ii. p. 457.

*Treatment.*—The first object to which we must direct our attention is the arrest of hæmorrhage, if such be present. When the bleeding is considerable, and cannot be restrained by pressure, it may be necessary to cut down upon, and ligature, one of the carotid arteries. If there be no accompanying wound of the air passages the edges of the incision may be united by sutures, whilst the head is maintained in a suitable position by means of pillows, bandages, and plasters. When a portion of the epiglottis is partially severed it is advisable to remove it entirely rather than to attempt to unite it by sutures, as absence of this organ is attended by little functional inconvenience. Should œdema of the glottis occur, it will of course be necessary to resort to tracheotomy. During cicatrization of the pharyngeal wound the patient must be fed by the aid of a tube passed into the upper part of the œsophagus. If this mode of giving food occasions spasm of the glottis, and irritates the throat generally, it is advisable to administer nourishment to the patient by means of nutritive enemata. Perfect rest of the parts is thus almost secured, and the dangers of such cases are materially lessened. Should extensive traumatic inflammation of the pharynx occur, it must be treated on general principles. In all cases of wounds of the pharynx, where the act of deglutition is not contra-indicated, the continual sucking of ice is a good local safeguard against subsequent inflammatory action.

## FOREIGN BODIES IN THE PHARYNX.

*Latin Eq.*—Corpora adventitia in pharynge.
*French Eq.*—Corps étrangers dans le pharynx.
*German Eq.*—Fremdkörper im Schlundkopf.
*Italian Eq.*—Corpi stranieri nella faringe.

DEFINITION.—*Foreign bodies introduced into the pharynx from without, and arrested there by being lodged in recesses, or by becoming impacted in a wall of that cavity.*

*Etiology.*—Foreign bodies often become arrested in the pharynx. The substances which have been most frequently found lodged there are lumps of meat, fragments of bone, and entire fish-bones, bristles, leeches, false teeth, buttons, coins, pins, and needles. I have, at different times, removed every one of the bodies named, except leeches. Occasionally persons are met with who appear to have a special predis-

position to the lodgment of foreign bodies in the pharynx, resulting either from carelessness in eating, impaired sensibility of the mucous membrane, or from some unusual irregularity of the walls of the pharynx, which causes substances to be easily entangled and arrested. Large foreign bodies generally become lodged at the lower part of the cavity, where the cricoid and arytenoid cartilages project backwards, or between the base of the tongue and the epiglottis. Small and sharp pointed bodies may become fixed at any part of the pharynx; but are usually found sticking into the tonsils, which, on account of their uneven surface, are especially likely to arrest passing substances; small substances may also be entangled in the pillars of the fauces, or in the lateral folds of the cavity. Sometimes a large or long body, as a needle or fish-bone, is found stretching across the entire width of the pharynx. With respect to leeches these animals have generally found their way into the throat in the case of travellers who, being overcome by thirst, have been obliged to drink ditch-water. Numerous instances of this kind, accompanied by sudden and alarming symptoms, have been observed and reported by practitioners from a very early date, Hippocrates himself giving detailed advice as to the proceedings to be adopted in such a contingency.[1]

*Symptoms.*—Small pointed substances generally occasion much discomfort, especially during deglutition, although respiration is not interfered with unless considerable inflammation is set up. Fragments of hard substances, such as bone, may cause ulceration or abscess of the pharynx,[2] but they more often merely give rise to localized inflammation and troublesome irritation. When an abscess occurs fistulous openings may be formed in the neck, through which the foreign body may eventually be expelled. Foreign bodies sometimes give rise to great danger, and may even cause death, from perforation of a large blood vessel, or the foreign body may penetrate the intervertebral substance and cause caries of the bodies of the vertebræ.[3] Bell[4] has reported the case of a lad who, having swallowed a sewing needle with his food, died on the tenth day afterwards from hæmorrhage. At the autopsy the needle

[1] Breschet: "Dict. des Sciences Méd." 1813, vol. vii. p. 16.

[2] Moore: Loc. cit.

[3] Fleury et Schupfe: "Nouveau Dict. de Méd. et de Chir." vol. i. p. 297.

[4] "Medical Gazette," 1842-43, p. 694.

(three inches long) was found fixed transversely across the pharynx, the wall of which it had perforated opposite the middle of the thyroid cartilage, whilst the point was lying in the common carotid artery. The larynx, trachea, and stomach were found filled with clotted blood. A somewhat similar case is related by Fingerhuth,[1] in which a piece of the stem of a long tobacco pipe became lodged in the side of the pharynx, and after an interval of eight months occasioned fatal hæmorrhage by wounding the carotid in a sudden movement of the head. In some cases swallowing becomes so painful that deglutition is rendered almost impossible. When a large foreign body is impacted in the pharynx, the chief danger arises from the probability of suffocation on account of the entrance to the larynx being obstructed. In rare instances the foreign body may become impacted in such a way as to press down the epiglottis and occasion sudden death. In such a case the patient appears to die in a fit of apoplexy.

If a patient complain of a foreign substance being arrested in the pharynx, a view of the parts can sometimes be obtained by placing the individual with his mouth open opposite a window, directing him to take a forcible inspiration, and pressing down the tongue with the finger. In most cases, however, the laryngoscope must be made use of, as by this appliance alone is it possible to inspect the whole of the pharyngeal cavity. When the parts are thoroughly examined in this way, it is rare that a foreign body, however small, escapes notice; but when nothing can be seen, further examination should be made with the finger, as it is possible that a small, pointed, semi-transparent body, such as a fish-bone or bristle, may in this manner be detected. Even coins have been discovered imbedded in the folds of mucous membrane which pass from the sides of the pharynx to the larynx, after having remained undetected for a considerable time in this position.[2] Thus a case is recorded in which a halfpenny remained in the pharynx of a child eight months, and was ultimately brought up by a fit of coughing.[3] In rare instances foreign bodies may get into the pharynx by penetrating the structure of the neck. In illustration of this fact an instance is on record in which a surgeon removed from the pharynx of a

[1] Preuss. "Vereinszeitung," N. F. vii. No. 23, 1864.
[2] Durham: "Holmes' System of Surgery," vol. ii. p. 519.
[3] Ogier Ward: "Trans. Path. Soc." 1848-49.

woman a sewing needle, which had been thrust into her neck half an hour previously.[1]

*Diagnosis.*—The history of the case, and inspection of the pharynx, will generally afford conclusive evidence as to the nature and position of the foreign body. It must be remembered, however, that the substance may sometimes have been swallowed or ejected a short time after its lodgment, though the patient may still continue to experience a sensation as if something were sticking in his throat. When the pharynx is unusually sensitive, or especially when a particular spot on its walls is in an irritable condition, a patient after taking food is very likely to imagine that something has become fixed in the throat. Hysterical women are particularly prone to become possessed with such an idea, and to persist in it for weeks or months in spite of all assurances as to the groundlessness of their delusion. Again, with respect to children, serious symptoms, due to the impaction of a foreign body in the throat, may be present, whilst the history of the case does not afford the slightest clue to the origin of the phenomena.

*Prognosis.*—If the foreign body can be removed, the prospect is of course perfectly satisfactory, but if it remain in the throat, the prognosis must depend on its size and nature. Thus a large body may threaten death from suffocation, and a small one may give rise to a fatal result by penetrating a vital part. A sharp body, such as a bone, is more dangerous in its remote consequences than a smooth one. Rokitansky[2] thinks that the impaction of small hard bodies, such as cherry stones, at the lower part of the pharynx may cause the formation of a diverticulum.

*Treatment.*—The pharynx being as thoroughly accessible to instruments as it is to vision, foreign bodies, lodged in its cavity, can generally be easily removed. Large pieces of soft substances, such as lumps of meat, may be seized with the fingers or with forceps and extracted, or they may be pushed down into the gullet with a probang. Coins can be removed with forceps, or if they are impacted at the orifice of the œsophagus the money-probang may often be used with success. Small pointed bodies, such as fish-bones, bristles, pins, &c., imbedded in the substance of the tonsils, or entangled in the folds of mucous membrane, are best seized by suitable forceps, and drawn out in the direction

[1] Jardine Murray: "Med. Times and Gazette," 1859, p. 468.
[2] "Pathological Anatomy" (New Syd. Soc. Trans.), vol. ii. p. 12.

of their long axis. Plates of artificial teeth can usually be most easily extracted by the aid of forceps. When summoned to a patient who is almost suffocated, it may not be possible to make a thorough exploration of the throat, and tracheotomy may be immediately necessary. The common, but fatal, practice is at once to use a probang, and to force the obstructing object onwards. A foreign body, comparatively harmless in the pharynx, is thus often driven into the larynx or even into the bronchi, or may become impacted in the œsophagus.[1] At the same time, great injury is often done to the soft parts. If the patient's respiration could support a probang, an inspection could certainly be made, but if he appear to be dying of apnœa, tracheotomy may be necessary before the extraction of the foreign body can be accomplished. When no foreign substances can be detected after careful examination, it is advisable, even though the patient's sensations lead him to believe that the cause of his trouble is not removed, to wait for some little time before subjecting him to further manipulation. For the sensations of the patient are often unreliable, and although the foreign substance may have been extracted, a feeling of heat, pricking, or constriction in the pharynx, may be experienced for some time afterwards. Such sensations deceive the sufferer by simulating the presence of some offending substance. By leaving the parts at rest, if there be any foreign body in the pharynx, it will often work its way out, and be swallowed or ejected by the mouth, or it can be subsequently removed. As a rule, the sensations which remain after the extraction of a foreign body, generally subside in a few hours, although in some cases they persist for several months, and cause the utmost misery. There is usually some hyperæmia, and probably also a morbid condition of the terminal nerve fibres. Such cases are frequently difficult to cure. The application, however, of astringents to the mucous membrane, and the employment of galvanism, usually relieve the symptoms after a time. In some instances change of air and scene is necessary, in order to dispel the impression, and travelling should be recommended. In ordinary cases the discomfort remaining after the removal of a foreign body from the pharynx, will be much alleviated by directing the patient to sip a little iced water from time to time, or to suck and swallow

[1] Schrötter: "Medical Examiner," March 23, 1876.

small pieces of ice. It must not be forgotten that occasionally two foreign bodies—especially fish-bones—may be present at the same time in the pharynx without the patient being aware that there is more than one substance. Hence, if the sensations remain after the removal of the foreign body, a further examination should be made. A remarkable instance of this occurred to me a few years ago. An eminent Glasgow surgeon consulted me on account of a fish-bone which had become lodged in his throat three or four months previously. I succeeded in removing a fish-bone from the lower part of the pharynx. I told him that "he might feel the sensation for a day or two, but that there could be nothing more in the throat." Two days afterwards the gentleman returned to me, saying that he felt sure there was another bone near the site of the one I had removed, and on making examination I found that his sensations were accurate, and that a second bone was lodged in the throat at the spot indicated. On its removal, no further unpleasant feelings were experienced. It may be remarked that, between the removal of the first and second bone, the patient had not partaken of any fish.

## NEUROSES OF THE PHARYNX.

*Latin Eq.*—Neuroses pharyngis.
*French Eq.*—Nevroses du pharynx.
*German Eq.*—Neurosen des Schlundes.
*Italian Eq.*—Nevrosi della faringe.

Definition.—*Disordered sensibility of the mucous membrane of the pharynx, or a perverted or impaired action of the pharyngeal muscles, due to central or local disease of the nervous system.*

Nervous affections of the pharynx are divided into neuroses of sensation and neuroses of motion.

### Neuroses of Sensation.

Under this head four conditions of the mucous membrane in which the sensibility is altered may be grouped, viz., anæsthesia, hyperæsthesia, paræsthesia, and neuralgia.

*Anæsthesia.*—This neurosis is generally of little clinical importance, but occasionally, according to Krishaber,[1] dimi-

[1] "Gazette Hebd." 1872, p. 772.

nished sensibility is one of the earliest symptoms of progressive bulbar paralysis. It is nearly always present in diphtheritic paralysis. In insane patients[1] it may occasionally, however, be found to exist without any motor disturbances, or may result from the action of certain drugs, such as morphia or chloroform applied locally. To cure the affection, galvanism may be applied to the part, and strychnine administered internally or introduced hypodermically.

*Hyperæsthesia.*—Abnormal sensibility is of much more frequent occurrence than the affection just described. It is met with very frequently in individuals otherwise perfectly healthy, and often forms one of the greatest difficulties the laryngoscopist has to contend with in order to obtain a view of the interior of the larynx. The introduction of the Eustachian catheter may also be rendered impossible on account of hyperæsthesia in the pharyngo-nasal region. It may be useful to mention here that even in the normal condition there is a considerable difference in the sensibility of various parts of the pharynx. Thus it is greatest on the arch of the palate, whilst the posterior wall of the cavity may generally be touched without provoking any reflex action. Every variety of hyperæsthesia may be met with in hysterical women, whilst an increased sensitiveness of the parts generally accompanies inflammatory conditions, acute or chronic. No special measures are demanded for the cure of hyperæsthesia of the pharynx, except when the practitioner requires to pass instruments into the cavity for the examination or local treatment of the adjacent parts. These will be described in the article on "Laryngoscopy."

*Parœsthesia.*—This condition may occur without any overt cause in hysterical women, but it generally follows the removal of a foreign body. The patient complains of something sticking in the throat, such as a hair, a fish-bone, or a rough fragment of some hard substance. When this morbid sensation is consequent on the previous lodgment of a foreign body it generally passes away spontaneously in a day or two; but sometimes, it may remain for months—or even years, as already explained under "Foreign Bodies in the Pharynx." When dependent on hysteria, the general measures usually adopted for the relief of the complaint should be employed.

[1] Ziemssen's "Cyclopædia," vol. vi. p. 993.

*Neuralgia.*—This affection of the pharynx has not hitherto been accurately described. Türck,[1] however, mentions some half-dozen examples (four occurring in females) where severe pains of the soft palate, principally on one side, were complained of. The affection appears to have been incurable in one instance, whilst the rest recovered in a few weeks under the influence of strong applications of nitrate of silver. Some of these cases, however, approached more nearly to simple hyperæsthesia or paræsthesia than to veritable neuralgia.

Many instances of this disease have come under my notice. In most of the cases the patients were young girls under twenty, but I have met with the affection in married women between thirty and forty. In some of these cases there was anæmia, and more rarely chlorosis, but many of the patients were otherwise healthy. In most of the cases the patients were not in the least hysterical. Sometimes there was local hyperæmia: sometimes anæmia. In the former cases, free scarification proved very useful. In nearly all instances applications of tincture of aconite, three or four times a day, were of the greatest benefit, and this drug has often proved, in my hands, the only remedy which gave relief.

### Neuroses of Motion.

*Spasm.*—This symptom is rarely met with except in cases of acute œdema of the uvula, intense pharyngitis, and hydrophobia. The constrictors of the pharynx, however, often participate more or less in spasmodic stricture of the œsophagus. Twitching movements of the palate, according to Wagner,[2] also occur in advanced cases of *paralysis agitans.* Thus, in a patient suffering from constitutional syphilis and paralysis of one half of the body (the palate not being involved) Wagner observed movements, synchronous with the pulse, on one side of the palate.

*Paralysis.*—There are four kinds of paralysis of the palate and pharynx:—(1) the affection, which is a frequent sequel of diphtheria, and occasionally met with after common angina; (2) the slight paralysis which is sometimes associated with facial paralysis; (3) the loss of power, which is one of the most marked phenomena of progressive bulbar paralysis; and (4) paralysis of the constrictors of the pharynx, which is always associated with a similar condition of the œsophageal canal.

[1] "Wiener Allgem. Med. Zeitung," No. 9, 1862.
[2] Ziemssen's "Cyclopædia," p. 993.

*Diphtheritic paralysis of the palate* is a common sequel of membranous sore throat. An analogous affection, however, sometimes follows a simple angina, and may perhaps arise from mere debility. Cases of the former kind have been reported by Drs. Gubler,[1] Broadbent,[2] Hermann Weber, Silver, and others; and Dr. Broadbent[3] has recorded an instance in which the disease (associated with loss of power of the adductors of the vocal cords and slight dysphagia) arose spontaneously in a child six years of age. It is probable that inflammatory disease of the pharynx, such as tonsillitis, general pharyngitis, putrid sore throat, or syphilis, may give rise to more or less disturbance of the motor apparatus of this region; but it is only in diphtheria that other nerve centres suffer, so that this fact affords a means of differential diagnosis. The voice acquires a characteristic nasal timbre, the modification of certain articulate sounds being very characteristic, owing to the impossibility of closing the naso-pharyngeal passage. Thus *rub*, *head*, and *egg* become *rum*, *hent*, and *enk*.[4]

On inspection, the velum pendulum palati and uvula are seen to be relaxed, and although during inspiration and expiration the uvula moves backwards and forwards under the force of the current of air, the power of voluntary raising it is, to a great extent, lost. This feature is generally unilateral, and when bilateral it always affects one side much less than the other, giving rise to a mere paresis of the muscles on the side least affected. There is also generally loss of sensibility in the veil of the palate. The affection usually comes on about a fortnight after the commencement of convalescence, and is sometimes followed by general paralysis or paresis of the muscles of the extremities. The patient first perceives the difficulty of swallowing, in taking fluids, which frequently regurgitate through the nose or pass into the larynx. This symptom is partly due to the implication of the depressors of the epiglottis. The power of expectoration is often lost, and mucus accumulates about the lower part of the pharynx, and is only dislodged by an effort of vomiting. The taste is always more or less blunted. In some cases a constant pricking sensation is felt in the throat. Some illustrative cases will be found under "Neuroses of the Larynx," and the

[1] Loc. cit.
[2] "Lancet," March 4th, 1871.
[3] "Clin. Soc. Trans." 1871, p. 92.
[4] Donders: "New Sydenham Soc. Trans." 1864.

various associated paralyses which occur in diphtheria are briefly described in the article on that subject.

Galvanism and faradism should be applied every day or two, by means of the laryngeal electrode until a decided amelioration of the symptoms is obtained. At the same time general tonics are indicated, and strychnia may be administered, either hypodermically or by the mouth. The patient should only be allowed to swallow *panada*, soups made almost solid by the addition of corn flour, and very firm wine jellies. Occasionally it may be necessary to feed with the œsophageal tube, or *per rectum*.

*Paralysis of the palate in association with facial paralysis* occurs, according to Erb,[1] when the cause of paralysis is situated above the geniculate ganglion. The uvula usually deviates to one side or the other—generally to the healthy side, and scarcely moves in phonation. This nerve-lesion does not require any special treatment, as it is merely an unimportant though interesting phenomenon sometimes occurring in connection with facial paralysis.

*Palato-glosso pharyngeal paralysis* is always one of the most marked phenomena of progressive bulbar paralysis. The disease is said to be rarely met with before the age of 40, but I have treated patients aged 27, 29, and 38. Exposure to cold is often the cause of the disease, but it has been likewise attributed to prolonged mental excitement, bodily fatigue, and insufficient nourishment. The malady commences in the tongue, next affects the lips, and soon after the palate and pharynx. There is indistinctness and slowness of speech at an early period of the disease from the imperfect mobility of the tongue, but before long the labial consonants and vowels cannot be properly formed, and all words in which *p b v f m* occur, and those commencing with *w y o u*, are indistinctly pronounced. As the disease progresses, speech becomes quite unintelligible, and dysphagia, which at a very early stage is present to a slight extent, becomes so severe that the patient can scarcely take an atom of food or a drop of fluid. His saliva cannot be swallowed, and dribbles from the mouth. The extreme dysphagia is partly due to the paralysis of the constrictors and partly to paralysis of the epiglottis, which, being unable to close over the larynx, permits the ingesta to enter the air-passage. The salivary secretion cannot be swallowed, and is at the same time abso-

[1] Ziemssen's "Cyclopædia," vol. xi. p. 496.

lutely increased in quantity. The patient can often only sleep sitting in a chair, with his head resting on the table, so that the saliva may run out of the mouth. If by chance, during sleep, the saliva reaches the larynx, the patient awakes with a fearful attack of spasm of the glottis.

The disease consists essentially in degenerative atrophy of the grey nuclei in the floor of the fourth ventricle, in sclerotic changes in the medulla and spinal cord, and in atrophy of the paralyzed nerves and muscles.

The disease is probably always fatal, the cases of supposed recovery from progressive bulbar paralysis having most likely been due to pressure on the medulla. Life is so distressing whilst it lasts, that the duty of the physician is to promote the euthanasia.

*Paralysis of the Constrictors* is characterized by dysphagia, and loss of power of the œsophagus always co-exists. The same treatment is required as that hereafter recommended for the œsophageal affection.[1]

## APHTHÆ.

### (Synonym: Thrush.)

*Latin Eq.*—Aphthæ.
*French Eq.*—Aphtheuse. Muguet.
*German Eq.*—Schwämmchen Aphthen.
*Italian Eq.*—Afte.

Definition.—*Inflammation of the mouth and throat characterized by the presence of whitish vesicles or ulcers, which frequently serve as a nidus for parasitic fungi.*

*Etiology.*—Aphthous spots are occasionally met with in the pharynx, though they are more common in the mouth. The affection is most frequently met with in new-born infants, and in these cases acidity of the stomach is almost always present; but it also occurs in the last stages of debilitating diseases, especially phthisis, and is occasionally met with as a sequela of measles. Aphthous affections are much oftener seen in cold, damp climates than in warm and dry regions. A low state of the system appears to be the most important factor in the production or predisposition

[1] This completes the list of diseases of the pharynx proper. Those which follow generally attack the pharynx in common with the mucous membrane of the adjacent parts.

to aphthæ. According to Fabre[1] the autumn season is most favourable to the occurrence of the disease.

*Symptoms.*—Small white spots or patches about the size of a pin's head are seen in the greatest number on the inside of the lower lip and cheeks, on the sides and under surface of the tongue, on the tonsils, and on the veil of the palate. Two stages can sometimes be recognized in the course of aphthæ, viz., a *vesicular* and an *ulcerative* condition, but sometimes there is a small patch of exudation from the commencement. The vesicles first appear as small elevations or papules, of a red colour, hard, and painful. They quickly become white at their summits, and are distended by a fluid which soon ruptures the vesicles. Small superficial ulcers, with steep sides and a greyish white floor result. The floor is covered by pultaceous matter, which is constantly secreted and thrown off—sometimes in large quantities. When the ulcers are about to heal they lose their whitish aspect, and the circumference gradually narrows, until a livid speck on the mucous membrane is the only trace of the former presence of the aphthæ. Sometimes the lining membrane of the mouth and throat looks as if it had been dusted over with flour—the whole of the mucous membrane being covered with minute white specks. When the spots and ulcers are very numerous they become confluent, and in some cases successive crops of vesicles continue to come out for several weeks. Great soreness of the mouth and fauces accompanies aphthæ, and in many cases a marked febrile condition of a sympathetic nature is excited by the malady. In the case of infants there is often diarrhœa with flatulency and colicky pains.

*Diagnosis.*—Separate spots of aphthæ are not likely to be mistaken, but when the disease is confluent the appearance of a false membrane is simulated, and close examination will be necessary, in order to diagnose between this malady and diphtheria. The whitish pultaceous matter which breaks up on being touched can be easily distinguished from the homogeneous, closely adherent, and tough membrane of well marked diphtheria, but there are some cases which occupy a middle ground and are very difficult to differentiate.

*Pathology.*—The nature of the affection has to a great extent been explained in speaking of the symptoms. It remains only to be added that a special fungus, the *oidium albicans*, is often met with in great quantities in the whitish cord-like matter which characterizes the disease.

[1] "Dict. des dict. de Méd."

*Prognosis.*—In infants aphthæ seldom cause death, but in rare cases the œsophagus may become ulcerated to such an extent as either to render swallowing impossible or to provoke ejection of food as soon as it reaches the stomach. In the last stage of debilitating diseases aphthæ generally constitute an unmistakable sign of approaching dissolution.

*Treatment.*—In the case of infants it is very important to attend to the diet, which, if possible, should consist of the mother's milk alone. Lime water, or the alkaline carbonates, are often of great service. As an internal agent chlorate of potash appears to exert a remarkable influence in hastening the disappearance of the aphthæ. Five or six grains may be given every four hours. Pernitrate of iron may also be used advantageously as an internal remedy. A general tonic and analeptic treatment will always be required in addition to other measures. The Mel Boracis, P.B., or borax diluted with white sugar (1 in 10), is an excellent remedy in the case of children. A pinch of the latter mixture should be placed at the back of the child's tongue, and allowed to dissolve. The pain and soreness are usually much relieved by the frequent use of honey or glycerine, with borax. Equal parts of glycerine and turpentine are very beneficial in the later stages. The ulcers can often also be successfully treated by daily application of sulphate of copper (gr. x. ad ℥j.). In the case of adults where there is great soreness, free cauterization with the solid stick of nitrate of silver affords immediate and marked relief. Sir William Jenner[1] first pointed out that in cases where a parasitic fungus is present a lotion of sulphite of soda (a drachm to the ounce) will kill the parasite, and thus cure the disease in about twenty four hours.

## DIPHTHERIA.[2]

*Synonyms.*—Several pages might be written of synonyms which at different times have been employed in describing diphtheritic affections, but simple inflammatory diseases,

[1] "Med. Times and Gaz." vol. vii. p. 183.

[2] Inasmuch as a diphtheria generally commences in the pharynx, and when it affects other parts, most frequently attacks them by extension, I have thought it right to treat the whole disease in this section. I am the more inclined to adopt this plan as I entertain the view that croup is only a form of diphtheria in which the local expression is found in the larynx and trachea—as it often is in the nares (with or without its occurrence in other parts). This proposi-

distinctly pellicular affections, and lesions of innervation have been so confused together by the earlier writers in medicine, that there is little or no advantage to be gained by collecting the numerous synonyms employed by different authors at various times. The term *diphtheritis* was originally suggested by Bretonneau, who, observing that the disease was differentiated from other similar maladies by the formation of a false skin or membrane, coined the word *diphtherite* from the Greek διφθέρα, a skin or parchment, and *ite* from ἴτης (εἶμι), hasty, impetuous, the well-known termination used in medicine to imply inflammation. Trousseau subsequently modified the word to *diphthérie*, in order to get rid of the etiological doctrine of inflammation which the affix indicated, and the term *diphtheria* was adopted by our Registrar-General. Names indicative of inflammation still hold their ground, however, amongst German and Italian writers.

*Latin Eq.*—Cynanche membranacea; C. maligna; C. pharyngea maligna; C. pharyngea epidemica; C. trachealis. Angina suffocativa; A. polyposa; A. membranacea; A. perniciosa. Diphtheria. Diphtheritis.

*French Eq.*—Angine couenneuse; A. fibrineuse. Diphthérite. Diphthérie.

*German Eq.*—Diphtheritische Entzündung der Rachen- und Kehlkopfsschleimhaut.

*Italian. Eq.*—Mala in canna. Difterite.

Definition.—*A specific communicable disease, occurring epidemically, endemically, and solitarily,*[1] *and characterized by more or less inflammation of the mucous membrane of the pharynx, larynx, or air-passages, and by the formation on the surface of those parts—especially on the mucous membrane of the fauces and windpipe—of a layer or layers of lymph or false membrane, generally showing signs of bacteroid mycosis. During an epidemic other mucous surfaces exposed to the air, and wounded surfaces of the common integument occasionally, but less frequently, become*

tion will be developed in the body of the article in some detail, and I have only to remark here that, by sacrificing the strictly anatomical arrangement of the work in this instance, I hope to give a better idea of the disease as an entity, than I could do if I treated the diphtheritic affections of the larynx and nose in separate sections.

[1] I have used this word in preference to the term "sporadic" which is commonly employed in connection with diseases supposed to be of spontaneous origin, or at any rate is applied to those which it is presumed arise from accidental causes, independently of any contagious influence.

*covered with a layer of lymph, subsequently to, or independently of, a formation of membrane in the more ordinary situations. The disease is generally of an adynamic character, is often associated with a disturbance of the renal function (albuminuria), and is frequently followed by lesions of innervation rarely giving rise to permanent paralysis. The symptoms as regards respiration, vocalization, and deglutition vary with the site of the disease. By far the larger proportion of fatal cases terminate by gradual apnœa, but a certain percentage sink from asthenia, blood-poisoning, and cardiac thrombosis.*

*History.*—The presence of a membraniform deposit in the fauces seems to have been regarded as a morbid condition, attended with considerable danger to life, from the earliest times. Hippocrates is supposed to have called attention to it more than two thousand years ago, and Aretæus has given a description which answers in many respects to the disease as now seen. But centuries before the time of Hippocrates an Indian writer had included in his "System of Medicine"[1] a description which is even more suggestive of diphtheria. The writer mentions a disease in which "an increase of phlegm and blood causes a swelling in the throat, characterized by panting and pain, destroying the vital organs, and incurable."[2] He also says, "a large swelling in the throat, impeding food and drink, and marked by violent feverish symptoms, obstructing the passage of the breath, arising from phlegm combined with blood, is called 'closing of the throat.'"[3] With these passages it may be well to contrast the description given by Aretæus of the Syriac ulcer, a malady which is generally considered to have more points of resemblance to the diphtheria of to-day than any other disease of antiquity. Describing ulcers on the tonsils,[4] Aretæus tells us that some are mild and harmless, while others are pestilential and fatal. The former—which are common—are clean, small, and superficial, and are unaccompanied either by pain or inflammation. The latter—which are rare—are extensive, deep, putrid, and covered with white, livid, or blackish concretion. Aretæus then goes on to describe the way in which, in fatal cases, the disease progresses, stating that "if it extends rapidly to the chest through the windpipe, the patient dies on the same day by suffocation." No more definite description of any disease which we can identify with diphtheria has been given, either by the contemporaries or the successors of Aretæus, and we must pass over many centuries before we come upon any authentic record of the prevalence of such a disease.

[1] This systematic work on medicine is written in Sanskrit, by D'hanvantare, and compiled by his pupil, Susruta. A Latin translation, by F. Hessler, was published at Erlangen in 1844, and is in the British Museum; it has the following title: "Susrutas Ayurvédas; id est Medicinæ Systema a Venerabili D'hanvantare Demonstratum a S. Discipulo Compositum." It is from this translation that the quotations in the text are taken.

[2] Ibid. p. 202.

[3] Ibid. p. 205. The following passage may also possibly describe diphtheria:—"Si quis valde lugens semper suspirat, interruptam vocem, et aridum solutumque sonum habet in respirationis viis, phlegmate oblitis, hic morbus propter suspirium vocis occisor cognoscendus est."—Ibid. 206.

[4] Aretæus: "De Causis et Signis Acutorum Morborum," lib. i. cap. 9.

It is not until we arrive at comparatively modern times that we find diphtheria forcing itself upon the attention of physicians as a distinct disease. Baillou, a distinguished French physician, who flourished in the last quarter of the sixteenth century, was the first to publish an accurate description. It is in his writings that we find the first definite mention of a false membrane.[1] A few years later, the same appearance was noted by several Spanish physicians as occurring in the course of an epidemic disease, which they minutely portrayed under the name of "garrotillo." The best description is that of Villa Real (1611), who states that he has seen a thousand times (millies vidi) in patients, at the first onset of the disease, a white matter in the fauces, gullet, and throat. He adds that this matter is of such nature that if you stretch it with your hands it appears elastic, and has properties like those of wet leather—facts which he noticed, not only by observing the matter coughed up by the living, but also by the examination of it in the dead.[2] The descriptions of Fontecha[3] (1611) and Herrera[4] (1615) are less satisfactory, as containing no account of post-mortem appearances; but they are valuable in so far as they confirm the fact of the prevalence of garrotillo in Spain between the years 1581 and 1611. Some years subsequently to the latter date diphtheria appears to have prevailed as a fatal epidemic in Naples and other parts of Italy. Sgambatus[5] tells us that in 1617 a highly contagious affection of the throat appeared, attacking the children of rich and poor alike, and often sweeping away whole families. The same epidemic is described by Nola[6] and Carnevale,[7] the latter of whom asserts that it was identical with that which had been prevailing in Spain, under the popular name of "garrotillo." The writings of Cortesius[8] (1625) render it nearly certain that the same disease extended somewhat later to Sicily. A membrane in the throat, which could be readily torn away, is distinctly described as being one of its symptoms. The works of Alaymus[9] (1632) and of Aëtius Cletius[10] (1636) have also been quoted as affording corroboratory evidence of the prevalence of diphtheria in Italy and Sicily during the seventeenth century. Medical literature is then silent on the subject for nearly a century, but after that time follows a rapid series of observations from different parts of Europe. In 1713 Dr. Patrick Blair,[11] in a letter to Dr. Mead, described a

[1] Gulielmi Ballouii: "Epidemiorum et Ephemeridum," libri ii. Parisiis, 1640, p. 201.—"Pituita lenta contumax quæ instar membranæ cujusdam arteriæ asperæ erat obtenta."

[2] Johannis de Villa Real: "De Signis, Causis, Essentiâ, Prognostico et Curatione Morbi Suffocantis." Compluti, 1611, p. 35, et seq.

[3] "Disputationes Medicæ," &c. opus Doctoris Fontecha. Compluti, 1611.

[4] "De Essentiâ, Causis, Notis, Præsagio, Curatione et Præcautione Morbi Suffocantis Garrotillo Hispane Appellati," auctore Doctore Herrera. Matriti, 1615.

[5] "De Pestilente Faucium Affectu, Neapoli Sæviente Opusculum," auctore Andrea Sgambato. Neapoli, 1620.

[6] "De Epidemico Phlegmone Anginoso Grassante Neapoli," Franciscus Nola. Venetiis, 1620.

[7] "De Epidemico Strangulatorio Affectu in Neapolitam urbem Grassanti et per regna Neapolis et Siciliæ Vagante," auctor Jo Baptista Carnevale. Neapoli, 1620.

[8] Johannis Baptistæ Cortesii: "Miscellaneorum Medicinæ Decades Denae." Messanae, 1625.

[9] Marci Antonii Alaymi: "Consultatio pro Ulceris Syriaci nunc Vagantis Curatione." Panhormi, 1632.

[10] "De Morbo Strangulatorio," opus Aëtii Cletii Siguini. Roma, 1636.

[11] "Observations in the Practice of Physic," &c. London, 1718.

disease as "the croops," which he says "was epidemic and universal" at Coupar Angus, and which was no doubt diphtheria. In 1748 Ghisi[1] observed an epidemic of the disease in Palermo; in 1749 Marteau de Grandvilliers[2] described a similar outbreak in Paris; in 1750 the formation of a membraniform concretion in the throat is distinctly described by Dr. John Starr,[3] as occurring in an epidemic in Cornwall, and in 1757 a similar observation was made by Wilcke[4] in Sweden. In the same year Dr. Huxham[5] described an epidemic which had been prevalent at Plymouth, in which some of the cases were examples of scarlatina anginosa, whilst others were undoubtedly cases of secondary diphtheria.

At length the attention of the profession was fully called to the peculiar characters of diphtheria by Dr. Francis Home[6] of Edinburgh, who, in 1765, under the name of croup described an acute affection of the larynx and trachea, coming on insidiously, attended with the formation of a membrane in the pharynx and air passages, and often causing death by suffocation. Home appears to have been the first to notice the quick, weak pulse which is so characteristic of the disease. The treatise of the Scotch physician attracted the attention of Dr. Michaelis[7] of Göttingen, who, in an essay published in 1778, confirms and supplements his observations. From time to time epidemics of scarlatina were described in which the throat symptoms predominated, and some of these have been wrongly supposed to have been examples of diphtheria.[8] The next record of the disease comes from America, where in 1789 Dr. Samuel Bard,[9] of Philadelphia, published a minute account of "an uncommon and highly dangerous distemper" which had recently proved fatal to many children in New York. Dr. Bard was a careful and painstaking observer, and his monograph contributed very considerably to the accuracy of contemporary knowledge with regard to diphtheria. In 1798[10] another American physician, Dr. John Archer, published an interesting paper, and recommended a new remedy for the disease. In the year 1801 Dr. Cheyne,[11] a British physician, published an essay in which he distinctly portrays diphtheria under the name of cynanche trachealis or croup. He recognizes it as the same disease as that referred to by Baillou, Ghisi, Home, and Michaelis, and gives a minute description and plates of the false membrane found in the trachea after death. In 1802 Dr. Cullen,[12] the well-known professor of the prac-

[1] "Lettere Mediche del Dottore Martino Ghisi." Cremona, 1749.
[2] "Dissertation Historique sur l'espèce de Mal de Gorge Gangréneux qui a regné parmi les Enfants l'année dernière." Paris, 1749.
[3] "Philosophical Transactions." 1752, vol. xlvi. p. 435.
[4] "Dissertatio Medica de Anginâ Infantum in Patriâ Recentioribus annis Observatâ." Wilcke, Upsalæ, 1764.
[5] "A Dissertation on the Malignant Ulcerous Sore Throat," 1757, though generally quoted by writers on diphtheria, is not referred to above, as it really deals with scarlatina anginosa.
[6] "An Inquiry into the Nature, Cause, and Cure of Croup," by Francis Home, M.D. Edinburgh, 1765.
[7] "De Angina Polyposâ sive Membranaceâ." Göttingen, 1778.
[8] "An Account of the Sore Throat attended with Ulcers," by Dr. John Fothergill. London: Fifth Edition, 1769.
[9] "Transactions of the American Philosophical Society." Philadelphia, 1789.
[10] "An Inaugural Dissertation on Cynanche Trachealis, commonly called Croup or Hives." Philadelphia, 1793.
[11] "Essays on the Diseases of Children, with Cases and Dissections," by John Cheyne, M.D. Edinburgh, 1801.
[12] First Lines of the Practice of Physic," by William Cullen, M.D. Edinburgh, 1802, vol. i, p. 219.

tice of physic in the University of Edinburgh, gave a description of cynanche trachealis, in which we cannot fail to recognize the diphtheria of modern times. For many years after its appearance Dr. Cullen's work was the favourite text-book on medicine with all British practitioners and students, and its author, therefore, may claim the credit of having rescued diphtheria from the region of discussion and monographs, and of having given it a fixed and recognized position in medical science. The disease, however, was evidently still a rarity in the British Isles, and it probably only occurred in the isolated form. In France the case was otherwise: the disease was well known as a frequent visitor, under the name of croup, and having caused the death of some of the members of the Imperial family in 1807, a prize was offered by Napoleon I. for the best essay on the subject. This led to the publication of the valuable works of Albers, Jurine, and Royer-Collard—works which were worthy predecessors of the classical memoirs of Bretonneau.[1] The latter owed their origin to an alarming outbreak of the disease at Tours in the latter part of the year 1818. The epidemic was most carefully investigated by Bretonneau, who published an account of his researches in 1826. An accurate description of "diphtherite" was given by Dr. Abercrombie in a work published in 1828.[2] The disease appears to have prevailed in an epidemic form in Edinburgh in the year 1826, but otherwise it was by no means a common affection in this country. In fact, after the brief notoriety conferred on diphtheria by the works of Bretonneau, the disease seems to have passed from the minds of English physicians, and its very existence to have been almost forgotten. It still occurred from time to time in all parts of Europe, but it did not excite attention to any great extent until the year 1853, when it broke out with some violence in Paris. In 1855 an epidemic at Boulogne, which was especially fatal to the resident English, excited considerable attention, and during the two following years serious outbreaks were reported from different parts of France. The first case of the greatest epidemic of the disease which, as far as is known, has ever occurred in this country, was imported from Boulogne to Folkestone in 1856,[3] but it was not till 1858 that the disease attained very alarming proportions in this country. Spreading, as it seemed, from many independent centres, it raged as a wide-spread and fatal epidemic during 1859, and continued very seriously prevalent during the three following years.[4] Since that time diphtheria has not appeared in England with anything like the same malignancy; it still claims several thousand victims annually, but its invasions are for the most part circumscribed in area, and both in this country, and on the Continent, only expand from time to time into limited epidemics.

*Etiology*—The *exciting* cause is a specific contagium, and those cases which appear to originate *de novo*, probably always arise from the virus—often long dormant and for-

[1] "Des Inflammations Spéciales du Tissu Muqueux et en particulier de la Diphthérite." Paris, 1826.

[2] "Pathological and Practical Researches on the Diseases of the Stomach," &c., by John Abercrombie, M.D. Edinburgh, 1828.

[3] "Reports of the Medical Officer of the Privy Council." No. ii. London, 1860.

[4] The best accounts of the epidemics of that period are those of Mr. Ernest Hart: "Diphtheria," London, 1859, and Mr. Netten Radcliffe: "The Recent Epidemic of Diphtheria,"—"Trans. of the Epidem. Soc." February, 1862.

gotten—of previous cases. Tender age is the principal *predisposing* cause, but the accidental existence of pharyngeal catarrh, or of any disease which lowers the system probably increases individual receptivity. Family constitution also often exercises an unfavourable influence.

The natural history of the contagium has not yet been elucidated. Some information has been obtained as to the atmospheric conditions and temperature under which the poison exists and flourishes, but considerable uncertainty exists as to the laws which govern its development and effect its diffusion. The mode or modes also in which the disease-producing virus enters the system, and its period of incubation, have not yet been accurately determined. These various points will now be considered in detail.

*The Natural History of the Contagium.*—The contagious principle has not been isolated, although it is highly probable that it consists of minute particles of matter, which are capable of floating in the atmosphere, and attaching themselves to rough surfaces (*see* Mode of Diffusion). The doctrine has been put forth by Oertel, Hueter, Nassiloff, and Letzerich, that a minute fungus is the essential contagium. The views of these authors will be referred to in detail in treating of the pathology, and it is sufficient to state here that the observations are not sufficiently conclusive to warrant us in considering that the essence of the disease has yet been discovered. Low vegetable organisms probably play an important part in the propagation of the disease, but the exact relation between the disease and the organisms has not as yet been made out. The experiments of Oertel, Letzerich, and others, if uncontradicted, would only show that micrococci are an invariable concomitant of diphtheria; that they are the sole or even the main agent in its causation cannot as yet be considered proved. Dr. Maclagan[1] has, however, clearly shown that "the germ theory" explains all the phenomena of the specific fevers, and in a matter, which at present is beyond *inductive* proof, analogy is of the highest value. For a further consideration of this subject, the reader is referred to the section on Pathology.

In considering the etiology of the disease, it is most important to determine whether it can originate *de novo* or not. Although the disease so often arises in connection with bad drainage, foul habits, and impure water supply; and although

[1] "The Germ Theory," &c. London, 1876.

it is so often impossible to trace the remotest channel of contagion, yet the whole tendency of sanitary science is opposed to the doctrine of the spontaneous origin of specific diseases.[1] It must not be forgotten that in those cases where the disease appears to enter the system through the use of drinking water contaminated with excrementitious matter, the specific germs of the disease, derived from persons previously suffering from it, may have found their way into the water. I have frequently known the disease occur suddenly in remote country districts, where careful inquiries have failed to discover the smallest evidence of infection, but similar phenomena are often observed in connection with scarlatina and small-pox—diseases which no one would now attribute to a spontaneous origin.[2] A very remarkable instance of the apparently spontaneous origin of the disease was observed last year by Dr. Semon, at a small health resort, called "Bad Fusch" in the Tyrol. The place, consisting of only two houses, is situated at an elevation of from 3,000 to 4,000 feet above the sea, and is celebrated for its fresh air and pure water. In one of these houses a little girl, five years of age, who had left Vienna five weeks previously, was suddenly attacked with diphtheria, which was subsequently followed by paralysis. The visitors consisted almost entirely of tourists, ascending the high mountains in the neighbourhood. Although other children had been playing with the little girl up to the day on which she was attacked, no other case of this kind occurred. It need scarcely be said that the outbreak of the disease in this case may, however, also be explained in accordance with the theory of contagion.

*Climatic and Atmospheric Conditions under which the Contagium Lives and Flourishes.*—The disease exists in almost every country, but it is most common in temperate climates. The contagium lives under ordinary atmospheric conditions, but it is probable that dampness favours its development. It occurs in the tropics, but does not appear to have been noticed in the Arctic regions. It seems likely that the germs

[1] Simon: "Sixth Report on Public Health," quoted by Dr. Aitken: "The Science and Practice of Medicine." Sixth Edition. Vol. i. p. 338.

[2] Dr. Kelly also states as the result of his experience as the sanitary officer of a wide tract of country, that diphtheria often appears in lonely outlying places, far away from any main road; and often no history of contagion can be traced at all.—"Second Annual Report of the Combined Sanitary Districts of West Sussex."

may remain dormant, *external to the body*, for a considerable period, and may only develop under the stimulus of some particular atmospheric conditions,[1] or when a suitable nidus presents itself. In making statistical inquiries, with reference to the registration of disease in sub-districts, Dr. Thursfield[2] found in certain isolated hamlets and houses where in recent years he had been called upon to investigate cases of diphtheria, that at intervals of five, ten, fifteen, twenty-five, thirty, and even more years, there had been previous outbreaks of fatal sore throat. An instance is recorded by Dr. William Squire[3] in which the virus remained latent eleven months, and then led to the development of the disease when a person occupied the room in which a case of diphtheria had previously occurred. I have known the poison to remain dormant for four, seven, and fifteen months, and in one instance for three years, and then again to become active. From the above considerations the vitality of the disease-germs would seem to be considerable.

In Great Britain the disease has generally been prevalent in those parts of the country where the rainfall is great, in villages situated in valleys, or in places where there is not sufficient fall to get rid of the surface drainage, but it has also been frequently met with, and shown great epidemic persistency, in high, dry, and exposed situations.

The disease is much more common in rural than in urban districts. Whether, however, this fact points to the greater humidity which prevails in the country, or to the absence of proper drainage, is not at present certain. According to Dr. Thursfield,[4] whose experience as a sanitary inspector extends over twelve hundred square miles, "with a population of rather more than two hundred thousand, of which rather more than one hundred thousand are rural, the number of fatal cases of diphtheria in the rural portion is nearly three times that in the urban portion." The same author remarks that whatever conditions seem to promote fungoid growth, would appear to favour the incidence and persistence of the disease, and the explanation of the comparative immunity of towns may be the presence of something in their atmosphere inimical to such growth.

Until recently the extension of the disease was considered to

[1] Sanné: "Traité de la Diphthérie." Paris, 1876, p. 231.
[2] "Lancet," vol. ii. 1878. Nos. vi. vii. viii.
[3] Reynolds' "System of Medicine," vol. i. p. 379.
[4] Loc. cit.

be independent of season, but the observations of Wibmer[1] and Thursfield[2] tend to show that it prevails more extensively during the winter months than at other periods of the year. Many severe epidemics have, however, steadily raged through the whole round of the year in spite of the most varied changes of weather and temperature.

*Mode of Diffusion.*—Considerable difference of opinion exists as to the mode in which the poison is diffused. The disease may be imparted to others by a person actually, or lately, suffering from it, but the extreme difficulty of effecting *artificial* implantation would tend to show that direct contagion is rare. From this fact it would seem probable that the contagium, when set free from the affected individual undergoes further development (as in the case of cholera and typhoid fever), which increases its disease-producing properties. It is asserted that the poison may be conveyed by a person not actually affected by the disease. Dr. Thursfield[3] has reported a very remarkable case, in which a woman living in an infected house, but not at any time suffering herself, walked a mile or two and crossed a ferry to visit a friend. She only remained a short time in the house, but sufficiently long to leave the germ of diphtheria, which broke out a day or two afterwards. This, however, is such an exceptional example, that the possibility of the malady having arisen from other sources must be borne in mind. In one instance I have known the disease caught from a patient who had entirely recovered from it four months previously, but whether it was conveyed by the person or the clothes of the individual, it was impossible to determine. In solitary cases the contagium does not usually assume a virulent form, and proper measures are almost invariably successful in confining the disease to a limited area. The distance at which the contagious principle can operate as a rule appears to be more limited than is the case in typhus or small-pox. Thus I have known an instance in which seven children were affected in a house which had a residence on each side of it, and a third opposite at a distance of only twenty-four feet. Although in all these buildings

[1] "Statistischer Bericht über die Münchener Epidemien, 1864—69," quoted by Oertel: Ziemssen's "Cyclopædia," vol. i. p. 590; also "Deutsch. Arch. f. kl. Med." 1870, vol. viii. p. 242; "Experimentelle Untersuchungen über Diphtheritis," p. 346.

[2] Loc. cit.

[3] Loc. cit.

there were young children, no other case of diphtheria occurred. Other similar illustrations of this fact are on record.[1] Under certain circumstances, however, the diffusive powers are increased, and, as appears to be the case in epidemics of influenza, the poison may be wafted over extensive tracts of country.

The germs of diphtheria appear to have an affinity for the walls of rooms, and, according to some observers, may attach themselves to clothes and articles of furniture.[2] It is probable that by the introduction of such things the poison is often diffused.

*Manner in which Poison Enters the System.*—The poison may be received into the system (*a*) by direct implantation; (*b*) through the circumambient air; (*c*) through the water that is drunk, or the food that is eaten. Further, it is possible that it may be occasionally introduced by inoculation, either with portions of false membrane or with the blood of a patient suffering from the disease.

(*a*) The melancholy deaths of Valleix and Henri Blache,[3] show that the disease may occasionally originate from direct implantation. M. Sée [4] has reported a case of the same character, in which a woman suckled a child affected with diphtheria. In consequence her own child, which she was nursing at the same time, contracted labial diphtheria, and communicated it to the mother, who frequently kissed her infant. An instance of direct implantation has been placed on record by Professor Bossi,[5] in which a greyhound was seized with symptoms akin to those of diphtheria four days after swallowing the excrement of a child who died of that disease; after death a membranous exudation was found on the animal's fauces.[6]

(*b*) The contagium which exists in the secretions and exhalations of the sick, may pass into the air and find its way directly into the healthy organism by absorption through

[1] Thursfield: Loc. cit. [2] Sanné: Op. cit.

[3] Trousseau: "Clin. Lectures," New Syd. Soc. Trans. vol. ii. p. 497.

[4] "Bull. de la Soc. Méd. des Hôp." t. iv. p. 378.

[5] Sir J. R. Cormack: "Clinical Studies," vol. ii. p. 273; "Lo Sperimentale," 1872, p. 230.

[6] Dr. Sanderson has placed on record a somewhat analogous illustration: Three sows which had access to a piece of waste ground on which "the discharges or concretions" of some patients suffering from diphtheria were thrown, quickly died with symptoms of suffocation, enlarged submaxillary glands, and in one case with diphtheritic membrane in the fauces. "Reports of the Medical Officer to the Privy Council." London, 1860.

the lungs, or through the mucous membrane of the throat; or the secretions of the sick may pass into drains, and sewer gas holding the disease germs in suspension, may be afterwards inspired.

(*c*) The poison may be conveyed through food or water (or other fluid used for drinking purposes), as in the analogous case of typhoid fever. Here it may be mentioned that Bossi's case, referred to above, may be an example of the manner in which the poison is absorbed through the alimentary canal—not an example of direct implantation. In many of the cases of diphtheria which I have seen during the last few years, the drinking water was found to be contaminated with excrementitious matter.

As regards direct *inoculation with diphtheritic membrane*, the experiments made with false membrane, by Trousseau,[1] Peter, and Duchamp,[2] upon themselves, and by Dr. G. Harley[3] upon animals, gave only negative results. In the experiments of Trendelenburg[4] and Oertel,[5] on rabbits, a diphtheritic membrane formed in the trachea, as the result of direct irritation of that part with diphtheritic matter, and the animals died on the second or third day, with acute kidney disease and symptoms of general infection. Nassiloff[6] and Eberth[7] have produced diphtheritic keratitis by direct inoculation, while Hueter and Tommasi[8] and Oertel, in their experiments on the muscles, found that soon after inoculation a diphtheritic layer appeared round the edges of the wound; hæmorrhagic inflammation was induced in the muscles, and the animals died on the second day from general blood-poisoning. Although in some of these experiments a false membrane was produced, the septicæmia may have been merely the result of inoculation with decomposing animal matter, and it cannot be considered that true diphtheria with its specific manifestations has yet been artificially produced by inoculation of the lower animals, though certain local phenomena of great interest and importance have been induced.

A few cases are on record in which medical practitioners are said to have been *inoculated with blood*, *i.e.* to have become infected through the accidental prick of a lancet smeared

[1] Ibid. p. 335.
[2] "Du rôle des parasites dans la diphthérie."—"Thèse de Paris." 1875.
[3] "Pathological Transactions," vol. x. p. 315.
[4] "Arch. für Klin. Chirurgie," 1869, x. 2.
[5] Loc. cit.
[6] Virchow's "Archiv." 1870, p. 550.
[7] "Correspondenzblatt," 1872.
[8] "Centralblatt f. Med. Wissenschaften," 1868, p. 34.

with the blood of a patient suffering from diphtheria, but as it is extremely difficult to inoculate successfully with blood in other diseases of much higher contagious power, it is highly improbable that diphtheria can originate in this way.[1] Moreover, it must not be forgotten that in the cases referred to the medical men attacked were exposed to the general influence of the contagion.

*Period of Incubation.*—The period of incubation is exceedingly short—generally two or three days—but on the other hand the germs of the disease may remain about the person subsequently attacked for some weeks before the complaint makes its appearance. In illustration of the first-named fact, the following case which came under my own observation may be cited. A girl, aged six, who had been absent from home for five weeks, returned one afternoon at four o'clock. Her young brother, aged four, had shown symptoms of sore-throat the same morning, but no suspicion was entertained that the disease was diphtheritic. These two children remained together till bed time, but did not sleep in the same room. The next morning both of them had marked diphtheria, with an abundance of false membrane. The little girl had not been subjected to any infection before reaching her home. On the other hand, I have known one instance in which the disease occurred fifteen days after exposure to contagion: A young lady, aged eighteen, insisted, contrary to the advice of her friends, in paying a visit to her cousins living in London, who were convalescent from diphtheria. She spent about two hours in their society, and then returned to her home in the country. Fifteen days after her visit she was attacked with diphtheria.

*Predisponents.*—The most obvious predisposing cause is *age.* From an analysis[2] of nearly 70,000 fatal cases contained in the returns of the Registrar-General, it appears that in every thousand fatal cases the age at death is as follows:—

| | |
|---|---|
| Under 1 year .. .. .. .. | 90 |
| From 1 to 5 years .. .. .. | 450 |
| „ 5 to 10 „ .. .. .. | 260 |
| „ 10 to 15 „ .. .. .. | 90 |
| „ 15 to 25 „ .. .. .. | 50 |
| „ 25 to 45 „ .. .. .. | 35 |
| „ 45 years and upwards .. .. | 25 |

[1] Dr. Klein: "Experimental Contribution to the Etiology of Infectious Diseases,"—"Quarterly Journal of Microscop. Sc." vol. xviii. p. 169, et seq.

[2] Thursfield: Loc. cit.

Again, in the Florentine epidemic[1], out of 1,546 cases occurring in the years 1872 and 1873, in only fifteen were the patients over thirty years of age. These figures are markedly different from any which could be compiled of other zymotic diseases. *Sex* does not influence the incidence of the disease to any appreciable extent; for although, according to the Registrar-General's returns, the mortality of females from diphtheria is rather higher than that of males, the reverse applies to "croup," a term under which a very large proportion of the cases of diphtheria are returned. Next in importance to age as a predisposing cause would seem to come *family susceptibility*.[2] The liability of diphtheria to attack the members of certain families is well proved. Sir William Jenner[3] lays great stress upon family constitution as being "one of the most important elements favouring the development of the disease and determining its progress." He quotes one case in which five members of a family took the disease, two in which four, and eight in which two were affected. In the Florentine epidemic, in four cases diphtheria proved fatal to three members, and in twenty-two cases to two members of the same family. Some remarkable instances of family susceptibility have come under my own notice. In one case a poor woman had three children of her own, and took care of two others in no way related to herself; her own children were attacked by the disease, and one of them died. The other two children—not her own, who were constantly in the same room with the little patients, never suffered from the disease. In another case four families occupied a house near Woodford, in Essex. In all of them there were several children. Two of the families were related, the mothers being sisters. All the children who were related to each other

[1] Dr. Borgiotti, Capo medico del Uffizo d'Igiene e Beneficenza, in the "Rendiconto amministrativo della Giunta al Consiglio Communale di Forenze," collected a series of the most valuable statistics on the Florentine epidemic of 1871-73, but unfortunately they are buried in the Municipal Archives. I am indebted to Dr. Wilson, of Florence, for most kindly copying Borgiotti's figures from the source referred to. Dr. Borgiotti's views are, however, given with considerable detail in the "Atti dell'Accademia Medico-fisica Fiorentina." 1871-72-73.

[2] Two very painful examples of intense family susceptibility have been recently reported; in one case eight, and in another case six children in one family were cut off by the disease within a few days. See "Lancet," 1877, vol. i. p. 919, and "Return of the Registrar-General of Ireland for the last quarter of 1876."

[3] "Diphtheria, its Symptoms and Treatment." London, 1861, p. 51.

had diphtheria severely, whilst the children of the other two families escaped entirely. During the progress of the disease no attempt at isolation was made, the healthy children frequently entering the rooms of the patients.

*Social position* is not without influence on the distribution of the disease. In its endemic form it rarely attacks those who live in healthy and well-ventilated houses. But where it is epidemic, it manifests no respect for social rank or wealthy surroundings. Under these circumstances, as Dr. Greenhow remarks, "station of life and the enjoyment of affluence, or exposure to the privations of poverty seem to have but small influence either in predisposing persons to take or to suffer severely from the disease."[1] The statistics of Dr. Borgiotti[2] tend to show that *during an epidemic* of diphtheria no importance is to be attached to the hygienic condition of a locality as a cause of the malady. In the Florentine epidemic many persons fell victims who lived in lofty, well-ventilated, and, in all respects, salubrious habitations. It must not be forgotten, moreover, that when diphtheria becomes epidemic in a town, an elaborate system of drainage is calculated to convey the poison by means of the sewers, and that water-closets afford a ready means of contaminating cisterns and introducing sewage gas into residences. Hence, the wealthy are sometimes subjected to causes of infection which the poorest may escape.

When an epidemic exists, the accidental occurrence of a catarrh often seems to attract the specific virus to the throat.

Certain acute diseases, as well as those of a chronic character accompanied with great debility, predispose to the disease, and when it attacks persons who have been previously suffering from some other affection it is called *secondary diphtheria*.[3] It is most apt to occur in measles and malignant scarlet fever, but it is met with in certain epidemics of small-pox, typhoid fever, and hooping-cough. It also, by no means unfrequently, attacks patients in the last stage of phthisis. The disease does not differ essentially in its character, whether it is primary or secondary, but it is thought by some physicians to be less contagious under the latter circumstances, and it attacks adults in relatively larger numbers.

[1] "On Diphtheria." London, 1860, p. 134. [2] Loc. cit.

[3] A description of the disease as a secondary phenomenon will be found in the succeeding articles.

Much still remains to be explained with regard to the etiology of diphtheria. No satisfactory theory has yet been offered as to the reason why in certain years the disease should spring up in epidemic form and resist all our attempts to arrest it, while at other times it arises, perhaps, in some remote hamlet, without any traceable antecedent, and, after flickering for a time, dies away as suddenly as it appeared.

*Protective Influence of an Attack of Diphtheria.*—As in the cases of typhoid fever and cholera, an attack of the disease probably affords a protection—though a very slight one—against recurrence. In estimating the protective power exercised by an attack of diphtheria, it must not be forgotten that even in diseases, such as small-pox and scarlatina, where previous attacks afford great subsequent immunity, recurrence does sometimes take place, and that there are many well-established cases on record of these affections occurring more than once in the same individual. The fact that diphtheria recurs, in some rare instances, does not therefore by any means disprove its protective influence in the majority of cases. I have myself known three instances in which children have died from the second attack. In two of these, the first attack (occurring a year previously in one case, and seven months in the other) was seen by another practitioner; but, from the circumstances of there having been slight paralysis in each instance, I have no doubt as regards the diagnosis. In my own case, I saw a child aged four with pharyngeal diphtheria in May, 1874, who died of laryngeal diphtheria under my care in July, 1875. I have seen the disease occur, in a mild form, three times in the same individual, at intervals of five months, a year, and two years.

*Symptoms.*—The symptoms of diphtheria vary in different cases from those of quite a slight sore-throat to those of the most serious and malignant blood-poisoning. Between these two extremes we meet with every gradation of intensity. The presence of "false membrane" in the throat is the characteristic symptom, but sometimes, in slight cases, the disease passes off without the formation of any membranous exudation, and occasionally the patient dies before it is developed. Again, the local affection is, in some cases, accompanied with considerable inflammation, whilst in others there is scarcely any hyperæmia. Hence it is convenient, in describing the symptoms, to classify the varieties of the disease. The following are

the different constitutional forms: (1) *The typical form;* (2) *the mild, or catarrhal form;* (3) *the inflammatory form;* (4) *the malignant form;* (5) *the gangrenous form;* (6) *the chronic form.* An attempt has been made to establish another variety—the insidious form; but whilst one author[1] finds its expression in the sudden development of laryngeal symptoms, another[2] considers that the patient either dies "from the progress of marasmus," "or suddenly from an effort," or quickly succumbs to one of the unfavourable complications which supervene. It will be seen, therefore, that the insidious character cannot be regarded as constituting a special form of the disease.

The student must not expect to find the first three forms always clearly defined; on the contrary, they are apt to run into one another, or their special features may be more or less combined. The differences dependent on site are—(*a*), *nasal diphtheria;* and (*b*), *laryngeal diphtheria* or *croup.* It would be foreign to the scope of this work to enter into the subject of cutaneous diphtheria, or to consider the local manifestations of the affection, when it attacks any of the various organs whose mucous covering is susceptible to the poison.

The course of (1) *typical diphtheria* is somewhat as follows: After a period of incubation varying from two to five days, during which the patient suffers from general *malaise* and depression, with occasional chilliness, the disease announces itself by a definite constitutional disturbance.

The *first stage* commences with a rapid rise in the temperature and pulse-rate—the former often reaching 103° and occasionally 104° F. within a few hours—an increased feeling of chilliness, loss of appetite, nausea, and in some instances vomiting or diarrhœa. If the patient is an adult he complains of pain in the loins, of headache, and often of giddiness. His attention is, however, soon diverted from these general symptoms to his throat, which in a very short time begins to feel hot and dry, and to cause pain in swallowing, whilst the neck feels stiff, swollen, and tender. In a child these subjective symptoms are to a great extent lost. The physician, called to a case such as is here described, will at once proceed to inspect the patient's throat, and will probably find the tonsils, the pillars of the fauces, the uvula, and the back of the pharynx red, swollen, and turgid. But the false membranes which are characteristic of the disease will very

[1] Jenner: Loc. cit. p. 20. [2] Sanné: Loc. cit. p. 123.

possibly have not yet made their appearance. If they have not, a few hours will probably suffice to develope them.

The *second stage* will then be present. On carefully watching the progress of the case a viscid yellowish secretion will be seen gradually accumulating in the depressions on one or both tonsils; a little later the superficial layers of mucous membrane become infiltrated at certain points with a yellow substance, which raises them above the level of the surrounding normal tissue. The infiltrated patches, which are at first more or less translucent, soon become opaque, at the same time changing in colour from yellow to a grayish white, extending at their periphery, and coalescing with similar adjacent patches. In this way a considerable surface of the fauces and pharynx becomes coated with false membrane, which, being constantly reinforced by additions to its under surface, gradually assumes a leathery consistence and a lardaceous appearance. Strips of this membrane may now be torn off, and in some cases with care the whole of it may be removed in the form of a cast of the parts on which it is deposited. The mucous membrane beneath will be found robbed of its epithelium, of a vivid red colour, and covered with numerous hæmorrhagic points. Externally the neck is more or less swollen and brawny, whilst the parotid, sub-maxillary, and lymphatic glands are frequently enlarged, hard, and tender.

The temperature in most cases gradually subsides as the exudation extends, but sometimes it remains at a high point, and may even increase as the local process develops. According to Faralli,[1] however, who made a series of careful observations on the temperature in sixty cases of diphtheria in the Florentine epidemic, it usually falls to normal by the fourth or fifth day, though in moderately severe cases it again shows a tendency to rise after that date.

The patient still complains of difficulty in deglutition, and suffers from a constant "hawking," caused by his endeavours to get rid of the tenacious secretion which is poured out from the mucous membrane. Unless the mouth is repeatedly washed out with a disinfectant gargle the breath becomes horribly offensive, from the decomposition of the morbid secretions in the throat. The *primary* blood-poisoning is shown by the extreme debility, the pulse being weak and compressible, and often either exceptionally rapid or exceptionally slow, while

[1] "Sul ciclo termico della difterite"—"Imparziale." Marzo, 1873.

the first sound of the heart is muffled, and devoid of tone; and by the albuminuria, which is an almost constant symptom in this class of cases, and appears at a very early period of the disease. The urine itself is scanty and high-coloured, containing an excess of urea, and numerous hyaline, granular, and epithelial casts.

It is at this period that the diphtheritic process, instead of limiting itself to the pharynx, may spread in a downward direction, and attack the larynx and trachea, thus exposing the patient to the serious risk of death from asphyxia. This extension, when it occurs, usually takes place within three or four days of the invasion of the disease, and is in most cases announced by unmistakable signs. The voice becomes hoarse and muffled, the breathing is more or less stridulous, and there is a constant dry and toneless cough. To these symptoms succeed those of embarrassed respiration, viz., distressing dyspnœa, gradually increasing cyanosis, swelling of the face, and drowsiness, passing into fatal coma. We have, in fact, a case of laryngeal diphtheria or true croup—one of the most fatal diseases to which humanity is liable. This important subject will be found treated in detail further on.

The other extensions are less important, but are of unfavourable signification. The implication of the nasal cavity generally announces itself by the discharge of a fœtid, dark coloured watery fluid, which excoriates the margins of the nostrils. This condition may remain until the patient recovers or dies, or it may be followed by the formation of false membrane on the lining membrane of the nose, and the discharge of fibrinous lumps through the anterior, or posterior, nares. It is sometimes accompanied by repeated and perhaps fatal epistaxis. Sometimes there is blocking up of the lachrymal duct, and consequent overflow of tears. Cases, indeed, occasionally occur in which the diphtheritic process extends by this route to the conjunctiva, and a plastic exudation takes place on that membrane. If the inflammation passes along the Eustachian tube, complaint will be made of roaring noises in the ears, of darting pains, and of deafness, which may be followed by perforation of the membrana tympani, and the discharge of a purulent fluid.

Supposing that the disease has not attacked the larynx the *third stage* now sets in, and the disease pursues one of two courses: it may subside, and the patient may slowly recover; or it may quickly end fatally.

If the disease terminates favourably a marked improvement in all the symptoms takes place generally at the end of the first or at the beginning of the second week. The swelling and injection of the mucous membrane steadily subside, the exudation ceases to extend, and portions become successively loosened and are thrown off. All the local discomfort rapidly disappears, and the general symptoms improve. The temperature and pulse-rate fall to normal and remain so, the appetite returns, the urine becomes of natural colour and quality, the skin resumes its functions, and with the exception of a certain degree of muscular weakness the patient feels quite well. He is not, however, as yet quite out of danger; it is not at all an unfrequent event for a relapse to occur, with a fresh formation of false membrane, and a return of all the most serious symptoms; or the heart's action may show signs of failure, and he may die of syncope. Even if he escape these contingencies, he may at a later period experience the discomforts of diphtheritic paralysis.

If the disease, instead of yielding, takes an unfavourable turn, the patient may either sink from *secondary* blood-poisoning, with typhoid symptoms, or coma may precede death; more often, however, death occurs from cardiac embolism or simple syncope.

(2) In *mild or catarrhal diphtheria* the symptoms are often so slight that the practitioner hesitates to attribute them to a disease, the very name of which is heard with consternation. Indeed it is, as a rule, only when his attention is aroused by the proximity of other undoubted cases, that he is at all likely to recognize the disease in its earlier stages. The symptoms are simply those of an ordinary catarrhal sore-throat. The diphtheria, in fact, has been arrested at the first stage of its development. The constitutional disturbance is very slight; the temperature rises a degree or two above the normal, and the pulse is quickened in proportion. There is slight pain, and a feeling of dryness in the throat, and as a rule some degree of difficulty in swallowing. The submaxillary and cervical glands are not unfrequently swollen and tender. On inspecting the patient's fauces, no characteristic exudation is seen. The tonsils, soft palate, and back of the pharynx are of a bright-red colour, and somewhat swollen. In many cases the redness and swelling are limited to one side of the throat, the opposite side presenting an appearance of perfect health. At first the throat is dry, and there is a marked diminution in the

quantity of the natural secretion ; but this stage soon passes, and then minute accumulations of yellowish matter, not much exceeding the size of a pin's head, may be seen adhering to the surface of the tonsils, or to the posterior wall of the pharynx. These may be readily removed with a camel's-hair brush. As a rule the patients quickly recover, and by the third or fourth day may be declared convalescent. They often, however, suffer from a considerable degree of prostration during the illness, and a sense of weakness may remain for some days or weeks after the disappearance of the local affection. The symptoms above sketched are sometimes associated with a trace of albumen in the urine, but occasionally the first evidence of the true nature of the throat affection is the occurrence of the characteristic paralysis. The appearance of one or other of these symptoms often forms the only clue which the physician has to the nature of the primary affection, which in all other respects closely resembled a simple sore-throat. In some instances, however, the catarrhal affection serves only to introduce the more serious form of the disease. In such cases, after the more trivial symptoms have lasted for three or four days, there is a sudden accession of fever, with marked constitutional disturbance and increase in the local symptoms. Exudation forms rapidly in the throat, and with it the disease assumes all the characters which have already been described under "typical diphtheria."

(3.) The *inflammatory form of diphtheria* is characterized by the active hyperæmia which precedes, and accompanies, the exudation of lymph. On examining the throat, the appearance is that of acute pharyngitis, the mucous membrane of the uvula and fauces being greatly inflamed. Within twenty-four hours a thick false membrane usually covers the inflamed parts, but I have met with one case in which the exudation did not take place till four days after severe inflammation commenced. The tonsils are often increased in size, and the glands at the angle of the jaw are generally enlarged, and tender. There is severe odynphagia. The pulse is very frequent, and the patient has a hot, dry skin, and often complains of great thirst. It is in this form of diphtheria, as Sir William Jenner[1] has pointed out, that the joints sometimes become swollen and inflamed.

(4.) In *malignant diphtheria* the attack begins with severe rigors, headache, and vomiting, and there is often also bleeding of the nose. The patient is at once, as it

[1] Loc. cit. pp. 17, 18.

were, knocked down by the virulence of the disease. Throat-symptoms are not generally severe, but the secretions rapidly undergo decomposition, and causes the breath to have a most intolerable fœtor. The temperature is not high, but the pulse is rapid, small, and irregular. Restless at first, the patient soon becomes apathetic and drowsy; his face grows pale, and his skin cold and clammy. The tongue is brown, dry, and tremulous, and sordes form upon the teeth. Hæmorrhages may occur from the various mucous surfaces, and petechiæ often appear beneath the skin. In short, all the symptoms of the typhoid state appear, and the patient finally becomes delirious and dies comatose, or succumbs to an attack of syncope.

(5.) *Gangrenous diphtheria* is very rare in this country, except as a secondary phenomenon following scarlet fever. The process generally supervenes very rapidly after the formation of the false membrane, and the symptoms are such as have been described under putrid sore-throat (page 39). These cases always terminate fatally.

(6.) *Chronic diphtheria* is a more rare disease. In the years 1863 and 1864 eleven patients (seven men and four women) came under my care in whose cases there was false membrane in the pharynx. In three of them at the same time there was deposit in the larynx. The patients were all able to attend as out-patients at the hospital, and though in several cases they were weak, yet they showed no very great degree of debility. In four instances there was albuminuria: in two of these it was intermittent and in two constant. The longest duration of any of these cases was three months, the shortest seven weeks, the average being nine weeks. In all the cases, when the false membrane was mechanically removed, bleeding occurred, and a fresh formation quickly took place. Various local treatment was adopted, but without any decided success. The power of maintaining the false membrane seemed to be lost after a time, and the lymph was at last separated without reproduction. Barthez[1] has also described a case where the false membrane lasted for several weeks, and showed a highly persistent power of reproduction, and Isambert[2] mentions an instance in which a student became affected with nasal diphtheria, and continued for several months to expel pieces of false membrane on blowing his nose.

[1] "Bull. de la Soc. Méd. des. Hôp." 1858.
[2] Lorain et Lépine: "Nouveau Dict." 1869.

Some of the symptoms of diphtheria demand a more detailed discussion than has been accorded them above.

The occurrence of *albuminuria* in cases of diphtheria was discovered by Dr. W. F. Wade,[1] of Birmingham, in the year 1857, and some months later it was independently observed by Dr. Germain Sée, of Paris.[2] In the greater number of cases of diphtheria the urine is found to be albuminous at some period of the disease. The albumen usually makes its appearance within the first few days, and sometimes within the first twenty-four hours of the invasion,[3] but it may be delayed until as late as the third week. Its presence is rarely constant in any case. It may fluctuate considerably in quantity from day to day and from hour to hour, and it may disappear and reappear more than once before recovery sets in. The severity of the case furnishes us with no indication as to the probable occurrence of albuminuria; it has been searched for in vain in some most malignant cases, and it has been detected in the course of very mild attacks. It is never associated with any tangible amount of hæmaturia, but the urinary deposit usually contains hyaline, granular, and epithelial casts of the renal tubules. The urine itself is generally more or less highly coloured, and of high specific gravity, and it contains a considerable excess of urea, as is the case in most other diseases of a pyrexial character. The albuminuria of diphtheria is almost always a transient phenomenon, and it is quite exceptional for it to persist after recovery. It seldom results in anasarca, and only very rarely in uræmia. In short, it is not by any means a dangerous symptom, and recent observations have fully confirmed the dictum of Trousseau,[4] that it has only a limited signification in relation to prognosis and treatment.

The exudation of *false membrane* is an almost invariable phenomenon of diphtheria. There are only two classes of cases in which it may be absent, viz., those in which death from blood-poisoning occurs before the exudation has time to form, and those in which the local process is not severe

[1] "Midland Quarterly Journal of the Medical Sciences," April, 1858.

[2] "Union Médicale." 1858, p. 407.

[3] Dr. Burdon Sanderson quotes a case in which it appeared eighteen hours after the patient had been apparently in perfect health. "Contributions to the Pathology of Diphtheritic Sore Throat," &c. "Brit. and For. Med.-Chir. Rev." January, 1860.

[4] Trousseau: Op. cit. vol. ii. p. 538.

enough to result in the formation of a definite membrane. This class has been described by Dr. Michel Peter[1] as "Diphtherite *sine diphtheria*." False membranes may form in the course of the disease upon any part of the mucous surfaces which are exposed to the air. As a rule, they attach themselves by preference to the more prominent parts. They may extend from the pharynx to the epiglottis and ary-epiglottic folds, and from thence by the ventricular bands and vocal cords, into the trachea, and may only be arrested in the smaller bronchi. They may spread upwards into the nasal passages, covering the whole cavity and following the windings of the turbinated bones. They may appear at the orifice of the nares and attack the excoriated skin around them: they may extend up the lachrymal duct and show themselves upon the conjunctiva. In some rare cases they have been known to extend into the œsophagus, and they occasionally cover the tongue and the mucous membrane of the lips. In women who are suckling infants the disease sometimes appears on the nipple. In both sexes it may attack the mucous membrane near the orifice of any of the internal passages. External wounds of every sort are liable to be covered by false membrane. In short, no part of the body which is at once open to the air and uncovered by a thick epidermis, is free from the liability of local infection and the consequent formation of false membrane. The exudation may take place within a few hours of the invasion of the disease, or may be delayed for four or five days. The first sign of exudation consists in the infiltration of the superficial layers of mucous membrane with a yellowish substance, which raises the affected parts above the level of the surrounding surface. The further changes which take place have been already described. When the first membrane has been removed artificially, fibrinous exudation may again form, or the surface may gradually heal. When, however, the membrane has become detached of its own accord, recurrence in the same spot is rare.

The symptoms of *fever* in diphtheria may either be very marked or almost absent. In the severest and most malignant cases the temperature is often quite low. There is never any tendency to extreme hyperpyrexia. In the usual run of cases it would appear that the variations of temperature follow a fairly definite course. Trousseau states that there is a rather acute development of fever at the time of the

[1] "Thèse de Paris," No. 270. Paris, 1859.

attack, but that the feverish symptoms diminish on the second day, and cease on the following or next day. Wunderlich considers that the temperature in diphtheria is of little prognostic value,[1] but Faralli, to whom I have already referred, has shown that there is a definite pyrexial cycle in cases of diphtheria, which furnishes data both for diagnosis and prognosis. The observations which he has made prove that fever is a phenomenon commonly present in diphtheria. The elevation of temperature is rapid, and even in slight cases it frequently rises as high as 104° in a few hours, falling gradually until the normal point is reached on the fourth or fifth day. In cases of moderate severity the temperature again rises towards the fourth day, but seldom regains the height of the first elevation. The exacerbation is due to the appearance of fresh diphtheritic patches on parts previously healthy, or, more frequently, to the appearance of glandular enlargements, the result of secondary infection. The effects of this secondary infection are clearly observed in severe cases which pass into the typhoid state. In these the temperature at first follows the same course as in the milder cases; that is, it rises rapidly and falls steadily until the third or fourth day. At that date it rises again, with some irregularity, but with a certain relation to the extension of the local disease, and to the putrefactive changes in the membranes. In favourable cases a second steady fall succeeds the second elevation, while in fatal cases the temperature continues to rise until the last. The natural course of the temperature may at any time be modified by the supervention of impeded respiration, which will have the effect of reducing it. Dr. Faralli's observations were not simply confined to pharyngo-laryngeal diphtheria. In a case in which diphtheria affected a wound, he obtained the same results. The temperature rose within a few hours to over 105°, before the false membrane was clearly developed. It fell to normal on the third day, while the infiltration was at its maximum.

*Cutaneous eruptions* are not uncommon in some epidemics of diphtheria, especially among children. Their most common situations are the neck and chest; occasionally they make their appearance on the face, abdomen, and thighs. A rash is most frequently met with in the severest cases. The date of its appearance is not definite, and its duration is very variable. Sometimes it disappears in a few hours, in other

[1] "Temperature in Diseases" (New Sydenham Society's Translation), p. 367.

cases it persists for several days. The rash of diphtheria generally more or less resembles the rash of scarlet fever, and consists of minute red isolated spots, which disappear on pressure. It differs from that of scarlet fever in the fact that it is never followed by desquamation.

*Sequelæ.*—Setting aside extreme debility and a disposition to cardiac syncope, which may be considered rather as characteristics of the disease itself, the only serious sequelæ of diphtheria are various local paralyses. These paralyses are liable to follow any case, however slight; they may be partial or complete, and they may either limit themselves to single groups of muscles, or may involve in succession almost the whole voluntary muscular system. Their advent is always gradual, and as a rule they declare themselves during the second or third week after the complete healing of the local lesion. Trousseau,[1] however, quotes a case in which they became manifest three days before the disappearance of the false membrane. On the other hand, they may be delayed until as late as the sixth week of convalescence. In any case their advance is gradual, and they may continue to extend for weeks after their first appearance. The muscles most frequently affected are those of the soft palate and pharynx, of the eye, and of the extremities. It is much more rare for the muscles of the larynx and trunk to be implicated, while those of the bladder and rectum are still more seldom affected, and those of the face, almost always, though not invariably, escape. Concurrently with the paralysis, there is impairment of muscular, and sometimes of cutaneous, sensibility. The muscles generally respond languidly to both galvanism and faradism, while the patient complains of numbness and prickings in the paralyzed parts. More rarely there is pain or hyperæsthesia. The affected muscles occasionally undergo some degree of wasting, and in some cases their diminution in bulk is very considerable. The first muscles to be affected are usually those of the soft palate and pharynx, which are almost always affected more on one side than the other.[2] The soft palate and uvula hang loosely, and cannot be drawn up at will. There is often also some diminished sensibility of the uvula, fauces, and epiglottis. The voice loses its resonance, and assumes a nasal character, while articulation is more or less embarrassed, and the patient is soon tired of talking. Swallowing is invariably rendered

[1] "Gazette des Hôpitaux," 1860, Nos. 1 and 5.

[2] See p. 115.

difficult, and fluids frequently regurgitate through the nose, or pass into the larynx. Occasionally life can only be sustained by the use of the œsophageal feeding tube. The paralysis of the pharynx generally impedes expectoration, and the secretion accumulates in the throat, and causes considerable discomfort.

Paralysis of the larynx is much less common than the palsies already described, but in rare cases it may appear even without other parts being affected. The paralysis may involve the whole muscular apparatus of the larynx, or may limit itself to single muscles. In the former case the vocal cords will be seen on laryngoscopic examination to remain motionless during phonation, occupying the post-mortem position. The voice is almost entirely lost, and any increased exertion leads to considerable dyspnœa, not from paralysis of the abductors, but from loss of power of the adductors, and consequent inability "to hold the breath"—an act which is especially necessary for delicate persons when making an effort. The muscular paralysis is occasionally associated with loss of sensibility of the mucous membrane of the epiglottis, in which case portions of food are more likely to make their way into the larynx than when the pharynx alone is affected. Such an accident may give rise to very serious symptoms. Where the paralysis only involves single muscles, it is the adductors which generally suffer, but often only one cord is affected. Two cases of permanent paralysis of the recurrent nerve, following diphtheria, have come under my notice.

Usually, the sense of taste is more or less blunted, and there is a loss of sensibility in the veil of the palate. In other cases the patient complains of numbness and a pricking sensation in the tongue and soft palate. The muscles of the eye are the next to suffer. Indeed, in some cases, they become paralyzed at the same time as the muscles of the palate. The patient first notices that it is getting more and more difficult for him to read small print. The effort tires him, and causes pain in his eyes; soon his vision becomes quite indistinct, and he suffers from flashes of light before the eyes. He does not, however, lose the power of seeing distant objects. At a later period there may be double vision, giddiness, and squinting, from palsy of the oculo-motor muscles. The earlier symptoms are due, according to Donders,[1] to impairment of accommodation from palsy of the ciliary muscles. The chief affection of the sense of sight, therefore, depends on paralysis

[1] New Sydenham Society's Translation, 1864.

of parts supplied by the lenticular ganglion of the sympathetic chain, as the pharyngeal paralysis appears to be due to impairment of Meckel's ganglion, and these facts have led Dr. Hughlings Jackson[1] to inquire, in cases of diphtheritic paralysis, for a corresponding affection of the sense of hearing, such as would be likely to result from interference with the function of the otic ganglion. He has hitherto only met with one such case, that of a medical man. The affection was not sufficient to impair his hearing for ordinary purposes, but "enough to render music unintelligible." In fact, as Dr. Jackson says, we should not expect deafness as the result of diphtheritic paralysis, but only slight interference with the power of appreciating high-pitched sounds. It is impossible to tell as yet how frequent such an affection may be in cases of diphtheritic paralysis. As far as our knowledge at present goes, it is little more than a pathological curiosity. Next in order to the muscles of the eye, those of the extremities most frequently show signs of paralysis. The lower extremities are usually the first to be affected. The patient first suffers from numbness and tingling in the feet. Soon, on attempting to walk, his legs begin to tremble, and he feels as though he were walking on air. The difficulty gradually increases, his movements grow more and more clumsy, until at length he loses all power over his legs, and becomes a helpless cripple. The muscles of the affected parts feel flabby to the touch, and they refuse to respond to the electric current. Cutaneous sensibility is also much impaired, or entirely abolished, especially in the soles of his feet. The same symptoms may occur in the upper extremities. There is, first, numbness and formication in the fingers, then increasing clumsiness of movement, and finally, complete paralysis.

The last muscles to be affected are generally those of the neck and trunk. Paralysis of the former in its worst forms deprives the patient of the power of raising or turning his head, which falls helplessly backwards, forwards, or to one side. Paralysis of the latter renders turning or moving in bed impossible, and at the same time causes considerable embarrassment to respiration from the implication of the intercostals. When the diaphragm is also paralyzed, as in rare cases it is, the difficulty of breathing is enormously increased, and the patient runs the greatest risk of dying from asphyxia.

[1] "Ophthalmology in its relation to General Medicine,"—"British Medical Journal," May 12, 1877, p. 505.

If, however, the paralysis be not complete, the danger may be warded off, and the patient may gradually recover. Concurrently with the paralysis of the extremities in the most severe cases, there is often incontinence of urine and fæces from palsy of the sphincters of the bladder and rectum. In men the sexual function is also affected in such cases, and the patient becomes temporarily impotent.

Having continued for a period varying from six weeks to half-a-year, these paralyses gradually disappear in the order in which they appeared, the duration being in each case proportionate to the degree of paralysis. If no unfortunate complications lead to a fatal result, eventual recovery of muscular power may almost invariably be counted upon; but in most cases the patient continues for a long time to experience some degree of weakness in the affected parts. Lastly, it is well to remember that the severity of the paralytic symptoms bears no proportion whatever to the severity of the antecedent disease. The loss of power may occur in a marked degree after even the most trivial attacks.

*Diagnosis.*—In some cases of diphtheria an absolute diagnosis may be almost a matter of impossibility, at any rate in the earlier stages of the disease. The difficulty generally arises in those cases which deviate from the normal type in the direction either of unusual mildness or of unusual severity. Very mild cases, in which the false membrane is either absent or late in appearing, may easily be confounded with ordinary catarrhal sore-throat. The diagnostic criteria are both few and indefinite. A history of infection, or the epidemic prevalence of diphtheria, may in some cases be of service in forming an opinion, but more often the practitioner has to trust to other data. In the case of the diphtheritic sore-throat, without false membrane, the congestion is at once more limited and more intense than in pharyngeal catarrh; it often affects one lateral half of the soft palate, or one tonsil, while the catarrhal process has usually a more general distribution. In simple sore-throat the surface of the tonsils may be covered here and there with patches of deposit, which might possibly mislead an ignorant or incautious observer; but such deposits will invariably be found to be soft, semi-fluid, and easily removed. They are, in fact, nothing more than the modified secretion of the congested mucous structures. In diphtheria, moreover, there is often albuminuria, and a degree of prostration out of proportion to the severity of the local changes. In many

cases, in the absence of false membrane, the practitioner must rest content with a diagnosis founded upon unsatisfactory criteria. In other cases, however, the sudden development of exudation and the appearance of serious symptoms of general infection may clear up all doubt; while in still rarer instances the supervention of muscular paralysis during convalescence will solve the problem in a quite unexpected manner. It is hardly necessary to add that, in all cases of suspected diphtheria, it is the bounden duty of the practitioner to make a most thorough examination of the interior of the throat, supplementing it, if possible, by the use of the laryngoscope and rhinoscope. These instruments will often bring to light patches of exudation, and will thus give very material help towards a satisfactory diagnosis.

The cases in which diphtheria appears in an exceptionally severe form may offer still greater difficulties in the way of diagnosis than even mild cases. A patient, for instance, is suddenly struck down by intense general blood-poisoning, and rapidly passes into what is named the typhoid state. If inspection of the fauces is neglected in such a case, the physician may experience the greatest perplexity as to the nature of the disease. Even the fauces may appear healthy, and the case be still one of diphtheria; for the membrane may not as yet have had time to form, or may have formed beyond the range of sight. The only aid to diagnosis in such a case will be found in the character of the prevailing epidemic. Malignant diphtheria very rarely occurs in an endemic form.

Apart from the above difficulties, diphtheria may simulate, and be simulated by, scarlet fever, confluent herpes of the throat, acute tonsillitis, and acute laryngitis. There can be no doubt that, in many cases, diphtheria has been mistaken for scarlet fever. The severe constitutional disturbance, the sore-throat, and the rash, which is a common symptom in some epidemics of diphtheria, are all liable to mislead the observer. But the points of difference are fairly well marked. The constitutional symptoms are usually slighter in diphtheria; there is, as a rule, less anorexia, but more prostration. The throat in scarlet fever is uniformly reddened, and if it be the seat of any membraniform deposits, these are soft and easily detached. The larynx, moreover, is only very exceptionally attacked. There may be albuminuria in either disease, but hæmaturia, which is scarcely ever

known to occur in diphtheria, is not uncommon in scarlet fever. The distinctive characters of the rashes have already been described.

Acute tonsillitis at its outset may simulate the inflammatory form of diphtheria. In both there is considerable constitutional disturbance and difficulty of swallowing; in both the throat affection has a more or less unilateral tendency, and commences with intense congestion. In tonsillitis, however, the inflammation either subsides, or rapidly passes into suppuration, and thus removes all cause of difficulty.

Confluent herpes of the throat is not a common disorder, and is not, therefore, often likely to give rise to difficulties in practice. Trousseau,[1] however, has laid down the diagnostic distinctions between the two diseases with considerable detail. Herpes is usually ushered in with considerable constitutional disturbance, but the temperature rarely rises higher than 102° or 102·5° Fahr., and it quickly subsides. The pain in the throat is of a peculiar smarting character. Herpes has no tendency to spread beyond the seat of its first efflorescence. Thus, if in a doubtful case the morbid process is found extending to the tonsils, to the larynx, or to the nose, herpes may be excluded. Of course the simultaneous appearance of herpes on the lip will be of great help in forming a diagnosis.

The diagnostic distinctions between laryngeal diphtheria and catarrhal laryngitis will be found under the head of "Croup."

*Pathology.*—The characteristic product of diphtheritic inflammation—the false membrane—is a tough dry substance resembling fibrin, or the buffy-coat of the blood. In colour it is yellowish, or greyish-white; it is firm and elastic, but it breaks across suddenly when stretched. The addition of acetic acid causes it to swell up and become transparent; it is dissolved by caustic alkalies. It is insoluble in water, and yields to it neither gelatine nor albumen. It thus closely resembles fibrin in most of its qualities. The membrane may vary from a thin and transparent pellicle to a skin of considerable thickness. The character of the exudation varies according to its age. In the earlier stages the different patches of membrane are more or less isolated, they are surrounded by mucous membrane in a state of intense hyperæmia, they project only very slightly above

[1] Op. cit. vol. ii. p. 439.

the mucous surface, and they cannot be removed without considerable force. Later on the patches are found to have coalesced, they have become firmer and thicker, and evidently project higher above the surrounding surface. In the next stage these edges become loosened, and show a tendency to curl up, giving the exudation a more or less cupped appearance. Pus gradually accumulates beneath it, until it detaches itself, leaving the subjacent mucous membrane in a state of catarrh.

According to the most recent researches, the exudation in *pharyngeal diphtheria* is seen under the microscope to consist exclusively of cells. The naked-eye resemblance to coagulated fibrin is due to a peculiar degeneration of the epithelial cells, and to an equally peculiar fusion of them one with another. The cells manifestly contain more solid matter than normally, but the precise character of the infiltration is as yet uncertain. On examining a section of membrane under the microscope, it is seen to consist of thin changed cells, fused together in various directions, and leaving a system of branching fissures, which permeate the whole membrane. The most superficial cells are twice as large as lymph corpuscles. They gradually decrease in size as we proceed deeper, until those which are in immediate contact with the mucous surface are almost indistinguishable from normal cells. Here and there, scattered throughout the membrane, are often seen minute extravasations of blood, which, originally formed on the mucous surface, have become separated from it and encapsuled by successive layers of degenerated cells. To sum up in the words of Rindfleisch,[1] "the false membrane is undeniably produced by the separation of young elements from the irritated mucous surface and by their gradual stiffening, sclerosis, glassy swelling, or whatever term we may choose to apply to their degeneration." In course of time the mischievous process comes to a standstill. The cells secreted by the mucous membrane no longer undergo the abnormal degeneration; pus cells appear in increasing quantities between the mucous surface and the false membrane, and soon lead to the final separation of the latter. The exudation also disappears to some extent by undergoing a process of softening, the cells becoming granular and fatty, and the network undergoing gelatinous degeneration. This, though not an uncommon

[1] "Lehrbuch der Pathol. Gewebelehre," II. Auflage, p. 310. Leipzig, 1871.

termination in favourable cases of tracheal diphtheria, is much rarer when the false membrane is formed in the pharynx.

In describing the symptoms of diphtheria, it has been pointed out that in the earliest stages of the disease the mucous membrane is inflamed and swollen, but is soon coated with false membrane, and becomes hidden from view. If the disease progresses favourably and the case is not very severe, on separation of the lymph, the mucous membrane is seen to be smooth, and often somewhat paler, than in a state of health; but, if the affection has been at all violent, more or less ulceration of the mucous membrane will be present. Occasionally the morbid process does not stop at ulceration, but gangrene results, and there is considerable loss of tissue. In many fatal cases the gangrenous process is in active operation, and its peculiar odour becomes evident on the post-mortem table, if not during life. The idea, entertained by the ancient physicians, that the disease was a gangrenous process was, it need scarcely be observed, derived from the appearance of the false membranes themselves, which, whether white or subsequently discoloured, have very much the aspect of an eschar or slough. This is, of course, only a delusive appearance, and our modern knowledge of the gangrenous process in diphtheria is based on the post-mortem examination of the tissues *beneath* the false membrane. In the severer forms of the disease there is, in addition to the changes above described, an exudation of fibrin into the sub-epithelial connective tissue. The exudation and infiltration sometimes compress the nutrient vessels of the part, and thus arrest its blood supply. Necrosis of the involved tissues results, and leads to the formation of a slough, which is, in course of time, separated from the healthy parts. On the slough becoming finally detached, there is left an ulcer of variable depth and extent. In several cases I have known the patient recover with the loss of his uvula, and with a portion of one or both tonsils destroyed. It is more common, however, in cases of recovery after gangrene to find large and puckered cicatrices resembling those which are seen as the result of syphilitic ulceration.

In addition to the inflammatory products of diphtheria, there are certain parasitic phenomena. The idea that diphtheria is of parasitic origin was first put forward by Professor Laycock [1] and subsequently revived by

[1] "Medical Times and Gazette," May 29, 1858.

Jodin.[1] More recently Oertel[2] has maintained the parasitic theory with great vigour, and has been followed by many German observers. Oertel contends that certain definite forms of vegetable life, especially the spherical bacteria, called *micrococci*, and the smallest forms of *bacterium termo*, are invariably associated with the diphtheritic process. The greyish-white hoarfrost-like patches which appear on the mucous membrane at the very commencement of the disease, contain, he says, luxuriant growths of micrococci. They are always present in diphtheritic membranes, and they are also found in varying quantity in the blood, whenever such membrane exists. The quantity of them present in any case, moreover, bears, it is affirmed, a direct relation to the intensity of the morbid processes; they multiply as the disease advances, and diminish with its retreat. Oertel states that the special form of micrococcus is never present in simple inflammation of the fauces or in mercurial stomatitis; but, that if the diphtheritic process supervenes on these disorders, it at once makes its appearance, and quickly displaces the more common forms of bacteria previously present. According to Oertel and some other experimentalists (*see* Etiology) after the inoculation of the different tissues of animals with diphtheritic exudation, it has been found that the micrococci force their way amongst the cellular elements, crowd into the blood and lymph vessels, which they render impermeable, infiltrate the muscles, and lead to their degeneration, and even reach the kidney, where they excite the inflammation which is so common a complication of diphtheria. Eberth[3] has gone so far as to declare that *without micrococci there can be no diphtheria;* while in Italy Giacchi[4] believes that a parasite is as necessary in the pathogenesis of the disease, as the *oïdium vitis* is in the production of disease of the grape. Letzerich[5] has found another fungus—the *zygodesmus fuscus*—which he believes is the essential cause of the disease. The conclusions of Oertel and Letzerich have, however, been directly controverted by Senator,[6] who

[1] "De la nature et du traitement du croup, etc."—"Revue Méd." t. i. pp. 22 and 134, Paris, 1859.

[2] Ziemssen's "Cyclopædia of Medicine," vol i. p. 589.

[3] "Zur Kenntn. der bacterit. Mykosen," 1872.

[4] "Natura e Terapia dell'angina difterica."—"Lo Sperimentale," Nov. 1872.

[5] Virchow's "Archiv." Bd. xlv. et seq.

[6] "Archiv. für Pathol. Anatomie u. Physiol." Bd. lvi. No. 12, 1872.

has found the *leptothrix buccalis* in diphtheria, and who considers the minute round bodies described by Oertel (as the spherical bacteria) to be the spores of the leptothrix. According to Senator the same fungi are found in diphtheria as in ulcerative, aphthous, and mercurial, stomatitis. In February, 1874, I examined seven cases for epiphytes, and succeeded in finding what is commonly described as "the leptothrix buccalis" in five instances. In every case, however, the fungus was in the superficial layer of the lymph. The importance of the presence of fungi in diphtheritic deposits is controverted by Dr. Beale,[1] whose authority, as a microscopist, must carry great weight in this country. This observer maintains that "vegetable germs are present in every part of the body of man and the higher animals, probably from the earliest age, and in all stages of health. . . . Millions of vegetable germs are always present on the dorsum of the tongue and in the alimentary canal." Dr. Beale further states[2] that "active bacteria introduced amongst the living matter of healthy tissues will die, although the most minute germs present which escape death may remain embedded in the tissue in a perfectly quiescent state." He thinks also "that there are very few morbid conditions that are unquestionably solely due to the growth and multiplication of vegetable fungi."[3]

The changes which may take place in other tissues in the course of an attack of diphtheria are very various: The *parotid* and *sub-maxillary glands* which Dr. Samuel Bard[4] first pointed out as being frequently swollen, have been recently shown by Doctors Balzer and Talamon[5] to be the subject of distinct pathological changes. The cells of the acini are generally either swollen and filled with a homogeneous mucoid material, or replaced by quantities of small round cells. Here and there are also frequently minute collections of pus. The *lymphatic glands* of the neck are almost invariably found to be more or less enlarged. On section they are redder than natural, and there is an evident increase in their cellular elements. The tissues around them, which during life were brawny and tender, are found at the autopsy to be infiltrated with serum and with

[1] "Disease Germs." London, 1872, p. 65, et seq.
[2] Ibid. p. 71.
[3] Ibid. p. 78.
[4] Loc. cit.
[5] "Revue Mensuelle." Le 10 Juillet, 1878.

scattered pus-cells. Often they present minute extravasations, while, in rare cases, considerable masses of blood have been found effused in the cellular tissue surrounding the glands.

The *lungs* may be the seat of very varied changes. The bronchial tubes are always inflamed—the inflammation generally being catarrhal, but sometimes purulent; in many cases, however, it is plastic, and then most commonly occurs on the fourth or fifth day of the disease. On laying open the bronchi, the false membrane is found attached to their walls, or lying loose in their channels, The membrane is never equally extended throughout the whole system of tubes, but seems to have a preference for those branches which run in a vertical direction. The fact of one of the lungs being bound down by pleuritic adhesion would seem especially to attract the morbid process in that direction. Exudation is not unfrequently found to extend to the minutest bronchial ramifications, in which case the alveoli are usually more or less implicated, and contain fibrinous threads, pus-cells, and, in some cases, blood corpuscles. As a rule, the lungs are more or less engorged and œdematous, especially at their bases; and frequently there are extensive patches of pneumonia of a low type, with emphysema, or more often mere insufflation of the air cells[1] in the immediate vicinity. In other cases scattered lobules are found collapsed and void of air from occlusion of the smaller bronchi, or one of the lobes is the seat of more or less extensive pulmonary apoplexy. According to Peter,[2] 59·50 per cent. of the cases of bronchopneumonia occur between the second and the sixth day. The *heart* has often an appearance of perfect health, but, in cases where death has occurred from general blood-poisoning, its muscular tissue is soft and friable, and contains scattered extravasations of blood. Under the microscope the muscular fibres show signs of fatty degeneration, and the blood is fluid and tarry. In other cases the opposite condition is sometimes found, coagula of considerable size being met with in the cavities of the heart and in the large vessels.[3]

The *spleen* and *liver* are often perfectly natural, but occasionally they are much engorged, and sometimes their capsules present extravasations of blood. The inner surface

[1] Jenner: Loc. cit. p. 38.

[2] "Gazette hebdom." 1864.

[3] Richardson: "Med. Times and Gaz." 1856. Meigs: "American Journ. of Med. Sci.," April, 1864. Beverly Robinson: "Thèse de Paris," 1866; and other authors.

of the *stomach* may be the seat of ulcers and sloughs, and hæmorrhagic exudations are occasionally met with, both in that situation and beneath the lining membrane of the intestines and bladder. The *kidneys* present marked changes in about half the fatal cases of diphtheria. They are swollen and engorged, and often contain scattered collections of blood. In other cases the changes are only visible under the microscope. Here the epithelial cells lining the tubules are found swollen and granular, and they have often undergone extensive proliferation, the crowded masses of young cells filling the tubes, and forming epithelial casts. Occasionally the Malphigian tufts and the tubules contain blood, and the latter are sometimes occupied by hyaline coagula.

The changes in the *brain* depend on the mode of death, and, if the patient succumbs to asphyxia, there is venous engorgement of the membranes and cerebral substance, and minute extravasations of blood. Pus and lymph have also been found on the arachnoid membrane, when the septicæmia has been very marked. In many cases where death has taken place whilst the patient was suffering from extensive diphtheritic paralysis, the muscles have presented no marked alterations;[1] and Morelli[2] goes so far as to say that "the anatomico-histological changes found in such cases are inadequate to explain the various forms of diphtheritic paralysis and paresis." In fact, the almost invariable restoration of these functions would seem to argue conclusively against these muscles being the seat of any serious degenerative change. In exceptional cases, however, serious and extensive lesions have been discovered. They were first observed by Charcot and Vulpian[3] in a case of paralysis of the velum palati. The motor nerves of the part consisted of tubules emptied of their medullary substance, their neurilemma containing numerous granular cells, elliptical in form, and in some instances, nucleated. In one case Buhl[4] found the nerves thickened at their roots, and the sheathes of the nerves crowded with lymphoid cells and nuclei. In a case of Oertel's[5] the muscles had undergone extensive fatty degeneration, while the substance of the brain, spinal cord, and spinal nerves was the seat of numerous extravasations of

[1] See two cases reported by Dr. Hermann Weber: "Virchow's Archiv." vol. xxiii. p. 115.

[2] "Lo Sperimentale," Decembre, 1872.

[3] "Compt. rend. de la Soc. de Biol." 1862.

[4] Ziemssen's "Cyclopædia," vol. i. p. 656.

[5] Ibid. p. 657.

various dates. There were also other marked changes in the spinal cord. Dr. Hughlings Jackson[1] has pointed out that muscles supplied in part through ganglia of the sympathetic system are especially prone to be the subject of paralysis. This is true of diphtherial amaurosis, and of the paralysis of the palate, and it would seem that the nerve-cells which give way are most largely represented in the higher ganglia of the sympathetic systems.

The most cursory study of the general pathology of diphtheria suffices to assure us that it is an acute general disease, with certain local manifestations. The *primary septicæmia* is due, in the first instance, to the specific poison, but absorption from the decomposing lymph is no doubt also a cause of *secondary infection*. In all cases the attack is associated with some degree of constitutional disturbance, while in the severest forms there is extreme disorganization of the blood and consequent implication of nearly every tissue in the body. The general infection is shown at a very early stage, as well as at a period when the local manifestations have disappeared. Besides the constitutional disturbance by which the attack is ushered in, there is the frequent derangement of the renal function, the marked prostration of strength, the functional disturbance of the heart, and at a later period the extensive implication of the nervo-muscular system. The local symptoms—the false membrane with its parasitic growths—must be looked upon as the first evidence of constitutional poisoning, in fact, as the first of the secondary phenomena.

*Prognosis.*—The mortality of diphtheria varies chiefly according to the age of the patient and the character and stage of the epidemic, and these points must consequently be borne in mind in giving a prognosis. The relative proportion of deaths to cases is by no means constant. In some epidemics it has exceeded 50 per cent. According to Dr. Borgiotti's statistics[2] of the recent Florentine epidemic, out of 1,546 persons attacked in the years 1872 and 1873 881 died; but as Dr. Borgiotti elsewhere[3] remarks, owing to the incompleteness of the health-returns, or, in other words, the probable omission of slight cases, these figures should be looked upon rather as the relation of "the *gravely affected* to the *dead*."

[1] Loc. cit.
[2] Loc. cit.
[3] "Atti dell Accademia," &c. p. 16.

The dangers which are most to be dreaded at the outset of an attack are, on the one hand, extension of the disease to the larynx, and, on the other, the severe blood-poisoning. In the former case the patient is exposed to imminent risk of death from asphyxia. In the latter a fatal result may occur from collapse, or the patient may rapidly sink with typhoid symptoms. At a later period, a fatal result may be brought about by repeated attacks of syncope, by general prostration without manifest cause, by exhaustion from constant and uncontrollable vomiting or from severe hæmorrhages, or by inflammatory complications such as secondary pneumonia or acute nephritis. In the case of infants death has resulted from inability to suck, owing to implication and consequent stoppage of the nasal passage. Death during convalescence most commonly results from paralysis of the heart, or of the muscles of inspiration, or from intercurrent disease of the lungs or pleura, or from general failure of nerve-force and exhaustion.

With regard then to the data on which a prognosis must be formed, the most important *general* consideration is the character and mortality of the prevailing epidemic. It may, perhaps, be laid down as a rule that of the cases in which a definite false membrane is present, one-third at least will probably prove fatal. Apart from other less known causes, the mortality in any epidemic will vary according to the form of the disease and according to the proportion of children to adults attacked, diphtheria being, for obvious reasons, far more fatal amongst children than adults. It must also be borne in mind that in certain families diphtheria has an exceptional tendency towards a fatal result. With regard to the *special* symptoms on which to found a prognosis, the following considerations chiefly deserve attention: High temperature, extreme prostration, hæmorrhages, or urgent vomiting at the commencement of an attack are signs indicative of extensive general infection, and must therefore be looked upon as of very serious prognostic import. Valuable information may be gained from the character and extent of the false membrane. *Ceteris paribus*, the prognosis is serious in proportion to the thickness and extent of the exudation. When the exudation shows a disposition to extend rapidly the danger is very considerable, as the extension is very likely to take place in the direction of the larynx. Prostration and a tendency to syncope are alarming signs at any period of an attack: their advent is often heralded by a very rapid or a very slow pulse,

with muffling of the heart's sounds, and intermittency of its pulsations. The presence of albumen is not, as I have already pointed out, a symptom of a serious import. During convalescence the extension of muscular paralysis to the muscles of respiration is the most alarming sign.

*Treatment.*—The symptoms of diphtheria are due, as I have shown, in part to a general blood infection, and in part to a local specific inflammation. Each of these pathological processes appears to run a cyclical course; in each the deviation from health is only a temporary one, which after lasting for a variable period, shows a tendency to subside and to terminate in the re-establishment of normal action. Each process, however, is attended with its own special danger, which may lead to a fatal issue, before the return to health. As regards the general condition it is the *intensity* of the morbid changes which constitutes the great danger; locally, the risk lies in the *occurrence of the exudation in a perilous situation.* The main objects in the treatment, therefore, will be to offer every possible resistance to the dangers arising out of these features. This will be accomplished in part by general and in part by local means, and neither form of treatment must be neglected.

*General Treatment.*—This should be directed towards husbanding and supporting the patient's strength by every available means. He should be placed, if possible, in a large, cheerful, and well-ventilated room, the air of which must be at once warm and moist. The temperature should be kept as nearly as possible between 60° and 65° Fahr. The patient's diet must be at once nutritious and digestible. Concentrated beef-tea, or beef-tea jelly, milk, and egg-flip must be regularly given at short intervals. Dr. Massei[1], who has seen a great deal of the disease at Naples, has pointed out that milk is often digested with difficulty in these cases, and under such circumstances it must be combined with lime water. Especial attention must be paid to feeding during the night, when the vital power of the patient is usually at its lowest ebb. There is often great distaste for food; in other cases swallowing is attended with considerable pain, while occasionally everything that is swallowed is immediately rejected. It is, however, the duty of the attendants to secure the due nourishment of the patient in spite of every difficulty. There are few cases of diphtheria in which systematic feeding does

[1] "Intorno alla Cura dell'Angina Difterica." Napoli, 1875, p. 54.

not constitute the most important part of the medical treatment. The administration of alcohol in small quantities is almost always advisable. In some cases, it is true, it may not be called for during the whole of the attack, but very often it supplies us with the best chance of saving the patient's life, and it must then be pushed with a boldness rarely needed in other forms of disease. Small doses of alcohol will usually be found sufficient in the earlier stages of an attack; two ounces of brandy or four ounces of wine in the twenty-four hours may be prescribed for an adult, and proportionate quantities for a child. In other cases, however, larger doses are required from the very commencement. But whatever be the earlier symptoms the physician must always be prepared to increase the dose rapidly, if the appropriate indications —attacks of syncope, irregular, very frequent, or very slow pulse, and delirium—present themselves. In these circumstances a high temperature does not in itself contra-indicate the employment of stimulants. In all cases it is necessary to keep a careful watch upon the pulse, which will give invaluable information as to the need for alcohol. Rapid and fatal failure of the heart often supervenes quite suddenly and unexpectedly, and the first indication of such failure is the signal for the unsparing use of the drug. Patients suffering from the exhaustion and prostration of diphtheria bear large amounts of stimulant without any of the usual intoxicating effects, and as much as twenty ounces of brandy have been given to an adult within twenty-four hours with manifest benefit. Champagne may occasionally be substituted for brandy, but this wine, in the active state of the disease, often causes pain in deglutition, and, as a rule, is more useful during convalescence. Whenever there are signs of approaching cardiac failure, it is important to keep the patient in bed with his head low, and to interdict any movement whatever. The neglect of this precaution has often been attended with fatal results.

Before passing to the strictly therapeutic treatment it is necessary to make a few remarks on blood-letting. It was at one time thought that general bleeding had a favourable influence on the spread of the exudation. Home strongly advocated it, and recommended in addition the application of leeches to the upper part of the throat. Bretonneau invariably used the lancet in his earlier cases. But experience soon taught him that deple-

tion neither extinguished the disease nor prevented the formation of false membrane, and he reluctantly abandoned it. Guersant, Trousseau, Bouchut, and Empis all came to a similar conclusion, and since their time the treatment by venesection has not been revived. Considering the serious danger of death from syncope and exhaustion to which patients are exposed when suffering from diphtheria, it is a matter for wonder that such treatment was ever thought of. The only rational excuse for its adoption was the theory that it prevented the extension of the local process. It has now, however, been almost universally admitted that general blood-letting has no influence whatever, unless it be an injurious one, upon the exudation. The same may be said, with scarcely less emphasis, of local depletion. The application of leeches to the throat may indeed relieve the pain and swelling, but such relief is dearly bought at the loss of even small quantities of blood, and the serious risk of diphtheritic infection of the leech-bites.

Of the general remedies which have been recommended in diphtheria there are four kinds, viz.: (1) The recuperative agents; (2) the alleged specifics; (3) the antiseptics; and (4) the expectorants. Some remedies, it will be at once perceived, belong to more than one of these divisions.

(1.) Of the *recuperative agents* iron and quinine are the most entitled to consideration. Of these iron is undoubtedly the most useful, and the profession is indebted to Dr. Heslop,[1] of Birmingham, for proving its value in diphtheria. It should be administered frequently and in large doses. Thirty minims of the tincture of the perchloride may be given to adults every two or three hours, and proportionate doses to children. It is well to combine it with glycerine, and, of course, it must be diluted with water. The general effect of the drug is often extremely favourable, and its local influence is equally well-marked, the soreness and pain in the throat being considerably relieved after each dose. The double effect is more surely procured by prescribing one of the persalts in preference to the less astringent protosalts. Quinine is occasionally required in the course of an attack of diphtheria. The special indications for its use are headache with high temperature, vomiting, and the symptoms of septic poisoning. In such cases the drug should be given in full doses, and should not be per-

[1] "Medical Times and Gazette," May 29, 1858.

sisted in if benefit fails to result in thirty-six or, at the most, forty-eight hours. As a rule, however, quinine is more useful after the more serious symptoms have abated, when it may be very suitably combined with iron and a mineral acid. Morphia and chloral are occasionally necessary to combat continued sleeplessness, and to ward off the exhaustion which is its invariable consequence.

(2.) The principal *alleged specific remedies* are: mercury, sulphide of potassium, bromine, and the balsams of copaiba and cubebs. The treatment of diphtheria by mercurials was at one time not less common than the practice of depletion, and it received a certain degree of support from the favourable influence which dusting with calomel is found to exert on diphtheritic wounds. But experience has long taught us that the general influence of mercury on the system rather promotes than checks the spread of the exudation. At one period mercury was vigorously pushed by Bretonneau,[1] but with very unsatisfactory results. From that time the use of mercury has been gradually discarded, and with such general consent that no one has since ventured to re-introduce it. Of the other alleged specifics, sulphide of potassium has long been regarded by Swiss physicians as a valuable specific, but it often produces both sickness and diarrhœa, and should not be employed. Bromine, which is best administered in the form of bromide of potassium, has not answered the expectations of its first advocate.[2] The well-known action of copaiba and cubebs on the mucous surfaces, led Dr. Trideau[3] to try these remedies in croup and diphtheria, and his experiments have been still further elaborated by Bergeron.[4] Dr. Beverley Robinson[5] has also lately strongly recommended the use of cubebs in the catarrhal form of diphtheria. This physician lays great stress on the importance of making use of the freshly ground powder. In catarrhal cases I have found distinct benefit from the use of the *perles* of copaiba. None of the various drugs just enumerated, however, can legitimately lay claim to anything like a certain and specific action.

[1] "Memoirs on Diphtheria," from the writings of Bretonneau, Guersant, Trousseau, Bouchut, Empis, and Daviot. Selected and translated by Robert Hunter Semple, M.D. London, 1859, pp. 77-93.

[2] Ozanam: "Comptes Rendus de l'Académie des Sciences." 1856.

[3] "Trait. de l'Ang. Couen. par le Baume de Cop. et le Poivre Cub." Paris, 1866.

[4] "Dict. de Méd. et de Chir. Prat." t. x. p. 361.

[5] "American Journal of Med. Science." 1876, p. 30, et seq.

(3) The *general antiseptics* include iron, chlorate of potash, carbolic acid, and salicylic acid with its compounds.[1] The value of iron has already been explained. Chlorate of potash, so useful in many affections of the throat and mouth, has also been largely used in diphtheria. Isambert[2] and Seeligmuller[3] have carefully studied the effects of this drug, and the general weight of evidence is very much in its favour. Ten to twenty grains may be given every two or three hours. I have not employed carbolic acid myself as an internal remedy, but the sulpho-carbolates as recommended by Dr. Sansom[4] have often proved of service in my hands, in the *secondary* poisoning of diphtheria. In the *primary* septicæmia, these remedies have appeared to me quite useless. Five grains of the sulpho-carbolate of soda in a little water may be given to a child of two years every three or four hours. Salicylic acid has been strongly recommended by Fontheim,[5] and I have used it myself in three cases with apparent advantage. The following is the formula which I have employed:—℞ Acid. salicylic ʒiss.; spirit. rect. ʒiiss.; aquam distill. ad ʒvj. M. Ft. solutio. One to two teaspoonfuls of this solution may be given every three hours. Great success is claimed by Dr. Hanow,[6] of Erlangen, for this remedy administered internally in half-grain doses every hour; but these observations require confirmation. The salicylates of soda and potash have also been strongly recommended. I have given the former remedy in two cases, but in both instances the disease was too far advanced for benefit to result. Salicylate of soda and salicylic acid have been recently found useless by Drs. Cadet de Gassecourt and Bergeron respectively.[7]

(4.) The use of *expectorants* has long been more or less in vogue. The principal remedies of this kind which have been found useful are senega, carbonate of ammonia, and the balsams. Senega was recommended as an expectorant by Dr.

[1] The sulphites introduced by Polli ("Brit. Med. Journ." vol. ii. p. 441, 1867) have been strongly recommended by Giacchi and Ferrini (whose papers are referred to in the body of the article), but I have not tried them myself.

[2] "Etudes Chim. sur l'emploi du Chlor. de Potasse dans les Aff. Couenneuses." Paris, 1856.

[3] "L'Union Médicale," 9 Juillet, 1878.

[4] "The Antiseptic Treatment." London, 1871.

[5] "Journal für Praktische Chemie." 1875, vol. ii. p. 57.

[6] "Mediz. Neuigk." Erlangen, May, 1875.

[7] "L'Union Médicale," 9 Juillet, 1878.

Archer[1] nearly one hundred years ago. It has since been frequently employed in this country, and is highly esteemed by Dr. West.[2] A dessert-spoonful of the officinal infusion, sweetened with a little syrup, should be given every two hours, but the effect of the remedy should be watched, and the quantity reduced if any vomiting occur. Carbonate of ammonia (two or three grains) may be given with the senega, or it may be administered in water. The balsams of copaiba and cubebs, though placed under the list of alleged specifics, probably act in a great measure as expectorants.

*Local Treatment.*—This has varied greatly at different times, and there still exists considerable divergence of opinion as to which method is most appropriate. Caustics and astringents, solvents and antiseptics, heat and cold, have all been in favour at different times and with different observers.

The use of *caustics* has, perhaps, been more general than that of any other class of local application. Bretonneau[3] strongly recommended a mixture of hydrochloric acid and honey, in the proportion of one part of the former to three of the latter, as a means of checking the local exudation. The caustic was to be applied only once in twenty-four or thirty hours, and its effects were to be carefully watched. Subsequent experience has shown that besides being attended with very considerable pain, the use of strong hydrochloric acid has no effect in controlling the spread of false membrane. The use of a solution of nitrate of silver, and even of the solid stick, at one time met with considerable support, and has been recommended by Bretonneau, Guersant, Bouchut, and Trousseau,[4] but it is being gradually abandoned by those who have had experience of recent epidemics. The same remark is true of sulphate of copper, and the acid nitrate of mercury, both of which have been recommended for the local treatment of diphtheria. In fact, the profession has given up the use of caustics altogether, being convinced that they rather aggravate, than check, the local process.

Various *astringents*, such as tannic acid, powdered alum, or perchloride of iron, have been used for many years, and still are largely employed. Tannic acid and alum are most

[1] Op. cit.
[2] "Diseases of Infancy and Childhood." Sixth Edit. London, 1874.
[3] "Memoirs on Diphtheria" (New Syd. Soc. Trans.). London, 859.
[4] Ibid.

conveniently administered by insufflation. Their effect is increased, as Dr. Loiseau[1] has pointed out, by using them alternately. Half a grain of tannin with half a grain of starch will be found the most convenient strength, whilst alum may be employed in the proportion of three-quarters of a grain of the salt to a quarter of a grain of starch. Insufflations are recommended to be used (by those who believe in their beneficial action) at least every hour or two. Perchloride of iron is best employed in the form of the tincture; it should be freely applied every two or three hours. The disease is sometimes checked by this class of remedies, but on the other hand, it sometimes irritates the throat—especially if there is much hyperæmia—and frequently increases the nausea and dislike to food which are so common. I now seldom use these drugs, with the exception of iron, which, when employed as a constitutional remedy, also acts topically.

Local agents which act as *solvents* have been introduced in modern times in diphtheria, with the view of getting rid of the false membrane without violence. The chief of these are: lime-water, solution of caustic potash, chlorate of potash, and lactic acid. Added to pieces of detached membrane in a test-tube, each of these substances has certainly the power of dissolving them; and whilst the false membrane is in contact with the living tissues, they have a similar, though less active, effect. Lime-water has been particularly recommended by Steiner,[2] and is certainly useful when the false membrane is not very thick. Sanné[3] has recently suggested a saccharate of lime, which has the advantage of being a more stable compound than lime-water. These preparations of lime can be applied either in the form of sprays or by means of a camel's-hair pencil. Liquor potassæ (one part of the liquor to four parts of water) can also be used in the same way. Of all the solvents, however, lactic acid is the most reliable. I generally apply it freely with a brush, or by means of a piece of lint attached to a wooden rod; the latter instrument permits of very free application. I have never met with the inconvenient results from the use of lactic acid which Küchenmeister[4] has

[1] "Gazette Médicale de Paris." 1862.

[2] "Zur Therapie der Diphtherie,"—"Jahrbuch für Kinderheilkunde," 1870.

[3] Op. cit. p. 429.

[4] Die Behandlung der Diphth. Angina durch Zertäubte Milchsäure." Dresden, 1870.

described—viz., ulceration of the mucous membrane of the lips and mouth.

In most cases of diphtheria *antiseptics* are very useful. The best antiseptics are carbolic acid, permanganate of potash, chlorinated soda, glycerine of borax, chlorate of potash, and hydrate of chloral. Carbolic acid may be applied in solution (gr. 3 to ℥j.), or in the form of Glycerinum Acidi Carbolici, B.P.,[1] or the Vapor Acidi Carbolici of the Throat Hospital Pharmacopœia, may be used. Dr. Massei[2] specially recommends the use of the alcoholized carbolic acid, the carbolic acid being in proportion to the alcohol, as 1 to 3, or 1 to 5, according to the severity of the local exudation. Permanganate of potash is most serviceable when employed at the strength of gr. v. to ℥j. The best formula for chlorinated soda is: Liquor sodæ chloratæ ℥iv., aquæ ℥x. Chlorate of potash may be given in almost any strength, though gr. xx. to ℥j. is generally found sufficient. Hydrate of chloral has also been found very serviceable by several practitioners. It was first recommended by Dr. Accetella,[3] and subsequently by Dr. Ferrini,[4] of Tunis, and has since been highly extolled by Dr. Cæsare Ciattagli,[5] of Rome, and Dr. Massei,[6] of Naples. In this country it has been employed with great success during the last two years by Mr. Hughes Hemming, of Kimbolton, to whom I am indebted for its recommendation. Mr. Hemming uses the syrup of chloral (gr. xxv. ad ℥j.), and directs that it should be employed every hour or two. It does not, as a rule, cause any pain, and the nurse can be easily taught to apply it. Mr. Hemming observes that, "whilst it rapidly gets rid of the fœtor, it is beautiful to see the membrane loosen and come away, leaving a healthy surface underneath." This remedy has also been very successfully used by Mr. Charles Hemming, of Bishops Waltham. One of the solutions above mentioned should be perseveringly employed in all cases of diphtheria where there is much false membrane. The antiseptic may be used either as a gargle or a spray; or the patient's mouth may be

[1] Dr. Sansom has, however, shown that the antiseptic qualities of carbolic acid are greatly diminished by the addition of glycerine (Op. cit. p. 20, et seq.)

[2] Op. cit. p. 43.

[3] "Campania Medica." No. 12, 1873.

[4] "Storia Clinica della Difterite osservata nella Città di Tunisi negli anni 1872-73." (Lo Sperimentale, Luglio e Settembre, 1874.)

[5] "Gazzetta Medicale de Roma." Maggio, 1876.

[6] Op. cit.

washed out with it by the attendant. In this way the horrible fœtor of the breath, which is so common in diphtheria, will be prevented. It must not, however, be expected that the use of antiseptic solutions will have any restraining influence on the exudative process, though it may, to some extent, destroy the parasitic fungi so frequently present in the exudation. There is also a class of remedies which, though not strictly speaking antiseptic, still by exclusion of air from the false membrane appears to have antiseptic influence. These are, in fact, *varnishes*, and consist of gummy matters dissolved in a fluid which evaporates quickly. I have tried gum benzoin, gum tolu, mastich, and resin. These substances can be dissolved in rectified spirits, or in ether, or a tincture of the gum or resin may be mixed with ether. On the whole I prefer the ethereal solutions (1 in 5), and tolu is most pleasant to the patient, and, lasting longest as a varnish, has to be least frequently re-applied. The surface of the false membrane should be dried with blotting-paper [1] before the application is made.

There yet remain two local applications to be considered, viz., ice and steam.

In many cases the patient will derive great comfort from frequently taking a piece of *ice* into his mouth. The annoying dryness and heat of the throat, as well as the dysphagia, will be thereby materially alleviated, and the inflammation sometimes arrested. The application of ice to the neck in a bladder or ice-bag is sometimes agreeable, and probably generally beneficial. The use of ice is especially indicated in the first stage of the disease, particularly in those cases where there is much inflammatory tumefaction.

On the other hand, heat is a very useful agent when the false membranes have attained any considerable degree of thickness. Hot fomentations applied externally to the throat are often found to relieve the pain in a remarkable way, while the use of *steam* inhalations appears to exercise an extremely favourable influence on the local process. As a vehicle for conveying a volatile medicament, steam has been recommended by many physicians, but as a remedy in itself for diphtheria it was first suggested by Dr. Prosser James.[2] The theory on which it is now used, however, is due to

[1] For holding the blotting-paper a miniature paper-clip, which can be fixed at different angles is sold by Messrs. Mayer & Meltzer, 71, Great Portland Street.

[2] "Sore Throat." 1861, p. 39.

Oertel,[1] who has earnestly advocated the employment of steam on scientific grounds. When it is found impossible to check the formation of lymph by the use of local remedies, the rational treatment is to convert, as far as we can, the inflammatory into a suppurative process. Such a transition invariably takes place before the return of normal conditions, and to promote this transition is equivalent to hastening the restoration of health. Oertel has found that the internal use of moist warmth facilitates the occurrence of suppuration more than any other agent, and he recommends repeated inhalations of hot vapour. He has observed that at the end of from twelve to eighteen hours, during which the inhalation has been practised hourly or half-hourly for ten or fifteen minutes each time, the margins of the diphtheritic deposits, which previously passed imperceptibly into the surrounding tissue, become more sharply defined, and contrast strikingly with the intensely reddened mucous membrane. The patches, therefore, at first sight seem enlarged. Besides this, the operation of the hot vapour has been to induce a considerable excretion of pus corpuscles. If the inhalations be continued, the false membranes will be seen to become gradually thicker and raised up from the mucous membrane. At the same time they change in colour, and their surface becomes wrinkled and uneven. After some days they are completely detached, and the mucous membrane is healthy, except for a variable degree of catarrhal inflammation. The inhalations may be made to serve another purpose, viz., that of cleansing and disinfecting the mouth, and with this object the Vapor Acidi Carbolici, or Vapor Pini Sylvestris (Throat Hosp. Ph.) may be used.

As young children cannot generally be induced to inhale the steam from an inhaler, "a croup-tent" should be erected over the cot for this purpose. An excellent portable apparatus[2] has been made for me by Messrs. Mayer. When the parts of the tent are put together, and a blanket thrown over

[1] Ziemssen's "Cyclopædia," vol. i. art. "Diphtheria," p. 675.

[2] The "portable croup-tent" consists of eight metal rods. Two of these representing the length of the tent are four feet long, and two representing the width are two feet six inches long. The four supports are two feet four inches in height. The eight pieces screw together, and when separated can easily be carried in the hand. A special cloth or blanket, sold with the frame-work, completes the apparatus. The croup-tent is exceedingly useful, not only in cases of diphtheria and true coup, but also in laryngitis stridulosa, for saturating the atmosphere with the fumes of nitre and stramonium.

it, it represents, on a small scale, the upper part of an old fashioned four-post bed (with the curtains drawn) such as is still common in the country.

The tent method of administering inhalations has been in vogue at the Children's Hospital for many years.[1] The steam-kettle[2] should then be placed near the tent, and steam passed within it.

The detachment of the false membranes, which has by some been advocated as a preparatory step to the application of remedies, cannot be recommended, except in cases where it may be necessary for the relief of urgent dyspnœa, or where putrefying membrane is lying loose in the throat. As a rule, the false membrane, when thus removed, rapidly reappears, and often with increased activity and over a wider area.

The above are the modes of treatment and kinds of remedies which are suitable in different forms of diphtheria. Many others might have been enumerated. As in the case of all diseases which are very fatal, a vast multitude of remedies have been most enthusiastically recommended, but I have referred to those only which I have myself tried.[3] It will perhaps give a more precise idea of the management of the disease if we suppose a certain typical case before us, and go through the various phases of treatment that may be required:

A child is attacked with a sore-throat during an epidemic of diphtheria, and an examination of the fauces shows that the disease has already commenced, thin patches of false membrane being present. The little patient should at once be put to bed in a large, well-ventilated room, and should be made to suck ice constantly, whilst a bladder of ice should be applied to the neck. A simple but highly-nourishing diet of beef-tea, eggs, &c., should be ordered, and stimulants as a rule be given from the very commencement. If there be evidence of primary blood-poisoning, twenty to thirty drops of the tincture of perchloride of iron and the same quantity of glycerine and five to ten grains of chlorate of potash, in half an ounce of water, should be

[1] Jenner: Op. cit. p. 83.

[2] An excellent steam-kettle is sold by Messrs. Allen, of Marylebone-lane.

[3] Bromine and sulphuret of potassium as general remedies, and chloral hydrate as a local antiseptic, are almost the only exceptions to this statement.

administered every three hours; if, on the other hand, the catarrhal symptoms be very marked, the balsamic treatment should be tried, and a capsule or *perle* of copaiba containing four minims of the balsam should be given every four or six hours. Local solvents should now be employed, and the throat should be sprayed every two or three hours with lactic acid solution, or, if the child will not allow this to be done, the pharynx must be forcibly swabbed with this remedy, or the syrup of hydrate of chloral may be applied in the manner already advised. If, in spite of this treatment, the disease advances, and the false membrane becomes thick and abundant, it should be painted with an ethereal solution of tolu (1 in 5), the surface of the false membrane being first dried with blotting-paper. This application, if thoroughly made, need not be applied more than once, or at the most twice, a day. Ice should now be given up, and warm inhalations, made antiseptic from time to time, constantly employed, by means of the croup-tent, in order to bring about suppuration and cause the false membrane to separate by the normal pathological process. It is useless continuing the copaiba any longer, and the iron often appears to lose its effect. It is at this period that the sulpho-carbolates sometimes have a wonderfully beneficial effect, and at this stage also quinine, in large doses, may be given at the same time with advantage. If the disease extend to the larynx or nose, the appropriate treatment hereafter detailed should be pursued. The third stage being characterized in favourable cases by the natural tendency to the separation of false membrane, the hot inhalations must be industriously continued, whilst the patient's strength is kept up by the use of highly nutritive drinks and stimulants. Such is the plan of treatment that may be pursued in an ordinary case of diphtheria. Complications of course require special remedies, and the sequelæ need appropriate restorative measures.

The impaired innervation of the lungs, which proves fatal in so many cases of diphtheria, is difficult to cope with. The most reliable measures consist in the assiduous administration of food and stimulants. The inhalation of weak ammonia has been recommended to meet this condition.

During convalescence the patient must still be carefully watched. The weakness and anæmia are best treated by iron and other tonics, by cod-liver oil, and by residence at some bracing watering-place. These measures are also appropriate in cases of muscular paralysis, but they then require to be

supplemented by other therapeutic measures, according to the special symptomatic indication. The slight palsy of the pharynx and soft palate, which is the commonest form of post-diphtherial paralysis, generally passes off in a few weeks without treatment. Where, however, there is marked loss of power of the pharynx, epiglottis, or œsophagus, so that the food is only swallowed with great difficulty, it may be necessary to feed by means of the œsophageal tube; indeed, this procedure may be absolutely necessary to prevent the patient dying from inanition. In less extreme cases the use of the feeding tube will serve to prevent the food from passing into the larynx, an accident which is likely to be followed by inflammation of the lungs, and is always attended with great danger to the life of the patient. Sometimes it is sufficient to feed the patient on thickened liquids (*see* page 116). When the paralysis is obstinate, and when it extends to the muscles of locomotion, the employment of electricity is indicated. Both the faradic and galvanic currents are useful, but they should be applied in a mild form. For the extremities, this treatment may be combined with friction and shampooing of the affected parts.

*Prophylaxis.*—Before concluding the treatment of diphtheria, it may be well to add a few words on its prophylaxis. When inspecting the patient's fauces, or cleaning or changing the tracheotomy tube, the practitioner should be very careful to prevent any of the morbid secretions from coming into contact with his lips or mouth, fatal results having followed the neglect of this precaution. Like precautions should also be impressed upon the attendants who have charge of a case of diphtheria. Orders should at the same time be given that no one but the attendants should enter the sick-chamber except upon urgent necessity; and all linen, spittoons, or other articles which the patient may have used should be carefully disinfected. By adhering strictly to these rules, it is generally possible to prevent the extension of the disease.

# LARYNGO-TRACHEAL DIPHTHERIA,

FORMERLY CALLED

# CROUP.

*Latin Eq.*—Angina trachealis.
*French Eq.*—Le Croup. Diphtherie Laryngée.
*German Eq.*—Häutige Bräune. Croup.
*Italian Eq.*—Il Croup; il Crup. Difterite laryngea.

THE term *croops*, or *croup*, has been used popularly in Scotland from an early period. The word "croops" was first employed by Dr. Patrick Blair in 1713, and "croup" by Dr. Home, a little more than a century ago. Since then it has been somewhat vaguely used, both by the public and the profession in all parts of the world to describe a certain train of laryngeal symptoms. The word is probably derived from the crowing breathing, which is such a frequent accompaniment of the disease it was intended to describe. It has many allies in other languages, the closest being the Dutch *Geroop*, a cry; but the following are doubtless all derived from the same root, viz., Icelandic, *Hròpa;* Anglo-Saxon, *Hreopan;* Gothic, *Hropjan;* Old German, *Hrof;* Modern German, *Ruf;* all words intended to represent the sound of the voice.[1] The Scotch word *Roup*—hoarseness, has the same derivation. On the other hand *croup* may be derived from the Gaelic *crup*, signifying a *contraction, i.e.*, contraction of the throat.

*History (The Relation of Croup to Diphtheria).*—Though the history of diphtheria has been already briefly sketched, it is necessary to make a few remarks to explain how a form of diphtheria came to be regarded as a distinct disease, and to point out how other laryngeal affections have been and still are—at least in this country—included under the name of croup. Until diphtheria appeared in England in 1858 the term "croup" was employed to describe an acute affection of the larynx, believed to be inflammatory and non-contagious, in which false membrane was present. The tendency of modern investigation, however, is to show that cases formerly described as typical examples of croup were in fact examples of isolated laryngeal diphtheria. French physicians, who since the time of Bretonneau had been more familiar with diphtheria than the profession in this country, almost universally regarded the two affections as identical. When the violent epidemic of diphtheria broke out in England, in the year 1858, it was natural that practitioners should fail to connect the epidemic affection with the typical croup (previously generally isolated or endemic) with which they were familiar.

[1] "Edinburgh Monthly Medical Journal," February, 1856.—"Observations on Croup," by Charles Wilson.

Although the antiphlogistic theory was on the wane, croup was still described in text-books as a disease requiring active and lowering remedies ;[1] whilst it was soon perceived that diphtheria could only be combated by analeptic treatment. Hence from the very outset an artificial distinction was created in the minds of practitioners.

Whilst the term croup had been strictly applied to the pellicular inflammation of the larynx, many laryngeal affections in which a shrill cough, or a crowing inspiration, was present, had been described as varieties of croup; and the terms "false croup," "spurious croup," "catarrhal croup" were in common use. These affections, which are still often mistaken for true croup (*see* Diagnosis), had still further warped the judgment of the profession as regards the true nature of laryngeal diphtheria. Near the termination of the great epidemic, 1858-62, in this country, the identity of the two affections was, however, advocated by the late Dr. Hillier,[2] and in my Jacksonian Prize Essay[3] (1863), I maintained the same view. The doctrine of identity has subsequently been urged with great earnestness and ability by Dr. Semple,[4] and his writings must have exercised considerable influence in this country.[5]

[1] Even Dr. Squire, in his able and comprehensive article published so lately as 1868 ("Russell Reynolds' System of Medicine," vol. i. p. 234, et seq.), recommends in certain cases blood-letting to the extent of three or four ounces for a child of four or five years of age.

[2] "Med. Times and Gaz." April 26, 1862.

[3] This essay is in the library of the Royal College of Surgeons, and an extract from it referring to the subject of diphtheria and croup was published in the "Brit. Med. Journ." March 5, 1870.

[4] "Croup and Diphtheria." London, 1872.

[5] Most physicians in this country who have had the opportunity of studying the disease in the wards and in the deadhouse now regard croup as a form of diphtheria. At an early period Dr. George Johnson ("Brit. Med. Journ." Feb. 19, 1870) maintained the identity of croup and diphtheria; and later, our great clinical teacher, Sir William Jenner ("Lancet," Jan. 2 and 16, 1875) gave in his adhesion to this doctrine. The renowned Traube, of Germany, had previously accepted the unity theory (Berlin "Klin. Wochenschrift," No. 31, 1872).

The advocates of the duality theory have based their views (1) on the supposed pathological differences, and (2) on the alleged clinical differences.

(1.) The supposed pathological differences in the structure of the two kinds of false membrane were formerly put forward as matters of great importance. Virchow,[1] the originator of these hypothetical distinctions, though admitting that the diphtheritic exudation was very similar to that of croup, maintained that the former was poured out *into* the substance of the mucous membrane, while the latter was only a coagulation *upon* its surface. On this hypothesis he founded what was once esteemed a most important point in practical diagnosis. The diphtheritic membrane, he asserted, could not be removed without tearing away portions of the underlying tissues, and leaving a bleeding surface. The

[1] "Archiv." 1847, p. 253, et seq.

croupous pellicle, on the other hand, could be easily detached, and the denuded surface would be found quite healthy, with the exception, perhaps, of a variable degree of hyperæmia. Before long, Virchow found himself compelled to surrender this distinction, as it was found in practice that the two forms of exudation passed into each other by insensible gradations. He now changed his ground,[1] and promulgated the view that death (necrosis) of the subjacent tissues was the characteristic and essential feature of diphtheritic exudation. Practically, however, this distinction was found to be no more satisfactory than the former, for cases came under observation which clinically answered to croup, but in which there was distinct death of tissue. It was also pointed out that the difference in the degree of adhesion of the croupous and diphtheritic exudations *is due to the difference in the structure of the parts on which they are thrown out.* The false membrane is naturally more closely adherent in the pharynx, where the epithelial layers on which it is deposited are not marked off from the subjacent tissues by any definite homogeneous basement membrane. On the other hand, in the larynx and trachea the presence of the basement membrane favours the separation of the lymph. It has thus at length been generally admitted that there are no sufficient naked-eye appearances to distinguish the croupous from the diphtheritic exudation. Nor have microscopical observers met with any better success in their endeavours to differentiate the two diseases. Dr. E. Wagner,[2] who has done the best work in this direction, has openly declared that his preparations of croupous and diphtheritic membranes are very much alike. The diphtheritic deposit he describes as a transparent, homogeneous, lustrous network, the interspaces of which are, for the most part, filled with lymph and pus corpuscles, though some of them are void of contents. The croupous membrane consists of a close network of delicate threads, the meshes of which contain numerous elements resembling pus cells. Wagner, however, differs from many other observers, holding that the network in both cases has its origin in a peculiar fibrinous degeneration of the epithelium, and not in the separation of a coagulable fluid from the blood. Rindfleisch[3] admits that

[1] "Handbuch der Spec. Path. und. Therapie," 1854, vol. i. p. 292. See also "Berl. kl. Wochenschrift," 1865, No. 2.

[2] "Archiv. der Heilkunde," 1866, vii. p. 481.

[3] "Lehrbuch der Pathologischen Gewebelehre." Third Edition, pp. 311-12

the pathological process in "pharyngeal croup" is the same as that which takes place in "laryngeal croup," and thus gives in his adhesion to the views maintained in the present article; but in spite of their anatomical identity, he feels bound to oppose any clinical fusion of the two diseases.

It will be seen from a consideration of the above facts that the pathological differentiation of the phenomena must be abandoned. We hence come to

(2.) The clinical differences. The supposed differences are

(*a*) The site of the disease; and (*b*) its manifestations.

(*a*) Diphtheria is said to be an affection of the pharynx occasionally spreading to the larynx, whilst croup, it is asserted, is essentially a disease of the larynx or trachea. The fact is, that croup is a disease which commonly commences in the pharynx, and only in about 10 or 12 per cent. of cases originates in the larynx or trachea. Difference of site, moreover, in a constitutional disease does not constitute a specific difference. Cancer is always cancer, whether the pharynx alone, or the larynx alone, is affected, or whether the two parts are attacked at the same time or consecutively, and rheumatism is still rheumatism, whether it affects the heart or the ankle.

(*b*) As regards the manifestations of the disease:

(1) croup is said to be a local disease, (2) to be a sthenic inflammation, in which (3) the lymphatic glands are not affected; and (4) in which there is no albuminuria, nor (5) paralysis; whilst

(1) diphtheria is a constitutional disease, (2) of adynamic type, in which (3) the cervical glands are inflamed, and (4) in which there is no albuminuria (5) nor paralysis.

To discuss these briefly:—

(1) It is true that in croup the general symptoms are not so severe as when the membrane is thrown out on an extensive portion of the pharynx. This fact admits of ready explanation, on the view that the septic symptoms are in part secondary to the local processes. For whilst the lymphatics of the mucous membrane of the soft palate, of the tonsils, and of the back of the pharynx have very free communications with the numerous glands below the angle of the jaw, the absorbent vessels of the mucous membrane of the larynx and trachea, are conveyed only to the solitary gland just below the greater horn of the hyoid bone, and the small gland at the side of the trachea.[1] There is, therefore, much less liability to general infection when the local process has seized only on the latter parts. When the primary septic poisoning is powerful the constitutional symptoms are, however, as marked in so-called croup as in diphtheria.

(2) Cases of sthenic croup are very rarely met with, and the same remark applies to diphtheria. On the other hand, there are medical men who assert that bleeding can be employed in diphtheria with success.[2] Hence distinctions based on differences of type in the two diseases can have no weight.

(3) The cervical glands are not often affected in croup, because the mucous membrane of the larynx has no communication with the

[1] Luschka: "Der Schlundkopf des Menschen." Tübingen, 1871, p. 156.

[2] "Courier Médical," Sept. 7, 1878. Dr. Simorre reports fifty-three cases of diphtheria treated by bleeding! All the patients recovered—most of them in twenty-four hours.

superficial cervical glands; on the other hand, as stated above, there is an elaborate connection between the pharynx and the lymphatic glands.

[In cancer of the pharynx also the cervical glands are always enlarged, whilst in cancer of the larynx the glands are seldom at all affected.]

(4) In croup albuminuria is often present.

(5) Paralysis is rare in croup, because nearly all the cases terminate fatally, but it is occasionally met with in those that survive.

I have entered into these details because details must always have a certain amount of significance; but it is more satisfactory to look at the question from a broad and philosophical point of view. Classifications are, after all, mere arbitrary arrangements by which knowledge may be placed in an accessible form for further use. The oldest classifications are purely symptomatic. When anatomy came to be mastered we had an anatomical basis for classification, and we are still obliged to make considerable use of this system; but as medical science progresses the disposition is to track disease to its origin, and seek out its hidden causes. Hence we see arising at the present day an etiological classification. The *cause* of disease, when it can be discovered, is now regarded as the essence of its specific nature. The ordinary inflammation of mucous membranes is attended with engorgement of the tissues, and the formation of pus on the surface; under the influence, however, of a certain poisonous contagium the inflammation, instead of being attended with the formation of pus, leads to the exudation of layers of lymph, which become adherent to the free surface of the mucous membrane. This disease is called "diphtheria," and whether the lymph is deposited on the mucous membrane of the pharynx, or larynx, or trachea, or bronchial tubes, or any other mucous membrane, or on a wounded surface, the disease is still "diphtheria." To suppose that there are two kinds of pellicular inflammations of the larynx, one in which the cause is the diphtheritic poison, and the other in which the cause is some other undiscovered influence, is totally opposed to all probabilities.

*Etiology.*—This has already been discussed under diphtheria.

*Symptoms.*—The disease develops in three different ways. It may originate in the larynx. This is *typical croup*, and probably does not occur in more than 10 or 12 per cent. of cases.[1] Most commonly it commences in the pharynx, and extends downwards, constituting *descending croup*. Occasionally, but very rarely, it commences in the bronchial tubes or trachea, and ascends into the larynx. This is *ascending croup*. If, as is commonly the case, the disease commences in the pharynx, the practitioner will be constantly on the watch to note the first invasion of the larynx, but in typical croup, or primary laryngeal diphtheria, it is otherwise, and

[1] See Sanné: Op. cit. p. 195. Sanné gives 142 cases out of 1,172. Compare also Simon: "Nouveau Dict. de Méd. et de Chir. Prat."

the symptoms of croup have been conveniently divided into three stages.

*The first stage* is often preceded by slight catarrh. So insidious is the invasion of the disease that the serious character of the child's illness is often quite unsuspected. The little patient is noticed to be languid and feverish, he is thirsty, and refuses food, and at the same time there is slight hoarseness, which the nurse attributes to an ordinary cold, until her apprehensions are aroused by a frequent, short, dry, shrill cough. The voice, which was at first only a little harsh, very quickly loses its resonant character and becomes a whisper. On examining the chest, both the inspiratory and expiratory sounds are found to be prolonged, and the normal respiratory murmur is lost in the laryngeal stridor which occurs in inspiration. The supra-clavicular spaces are usually somewhat more depressed during inspiration than in the condition of health, and the slight difficulty of breathing which is present is more marked during sleep. The pulse now becomes considerably increased in frequency, and the febrile symptoms generally more pronounced. If a laryngoscopic examination can be accomplished, the mucous membrane of the larynx is seen to be of a bright-red colour, and when the disease has existed for a few hours some thin patches of false membrane may be perceived on the mucous membrane of the larynx. The usually pendent position of the epiglottis in children often prevents a satisfactory examination even in those of tractable disposition; but the timidity of early life is in itself often sufficient to render the employment of the laryngoscope impossible. It is most important at this stage of the disease to make a very careful examination of the sputa. Children very often do not expectorate at all, but anything that is brought up must be put into a glass vessel and gently shaken with a little pure water. The mucus dissolves, and flocculi or small shreds of false membrane, if present, become visible.

*The second stage* is characterized by increasing dyspnœa, and by the attacks of suffocation which suddenly supervene from time to time. When the attack comes on the child is generally found sitting up in bed, with red and swollen face, and an anxious, terrified look. The nostrils are rapidly working, inspiration is hurried and "croupy," and is evidently performed with the greatest difficulty, all the auxiliary muscles of inspiration being called into play. The voice is almost inaudible, and there is a constant hoarse and stifled

cough, without expectoration. The attack generally lasts three or four minutes, and the patient subsides into a heavy sleep which often continues for several hours. Sometimes unmistakable pieces of membrane are thrown up with the cough, a phenomenon which is often most important as a means of diagnosis, as in many children suffering from laryngeal diphtheria there are no patches of exudation to be detected on a casual inspection of the fauces. It is only on careful and persevering examination with the laryngoscope in cases favourable for examination that the membrane, which is the source of all the trouble, can sometimes be recognized adhering to, or perhaps lying loose, in the chink of the glottis, and obstructing the passage of air. Occasionally the vomiting which is induced by the constant fits of coughing, or by the administration of emetics, may lead to the separation and ejection of large pieces of membrane, in which case the urgent symptoms of dyspnœa are often most strikingly relieved. The mode in which separation takes place is exactly the same in the larynx and trachea as in the pharyngeal region; the process, however, is rendered easier by the arrangement of the mucous membrane, which, in the trachea and in the lower parts of the larynx is separated from the submucous tissues by a distinct basement membrane. But the improvement due to the expulsion of the concretions is generally only temporary; exudation again collects, and the symptoms return in greater intensity than before. At this stage of the disease the pulse is very rapid, and generally irregular. The little patient is exhausted and is constantly bathed in sweat.

*The third stage* now supervenes. As the disease advances the suffocation becomes more urgent, and there is *no remission between the attacks, the dyspnœa being constant*, though fearfully aggravated every few minutes. The lips assume a livid colour and the nails become blue. The sternum and the intercostal spaces are forcibly drawn inwards during each effort at inspiration, whilst the agony of impending suffocation is most distressing to witness. The child throws his arms wildly about, or clutches his throat to tear away, as it were, the obstruction, or he thrusts his fingers into his mouth to seize the offending substance. The symptoms of fever are intensified, the thirst is urgent, the tongue thickly furred, and the pulse quicker but weaker. The little patient dies in an attack of dyspnœa or soon succumbs to gradually increasing coma, to syncope, or exhaustion.

*Diagnosis.*—In children it is sometimes very difficult to distinguish *catarrhal laryngitis*, of a severe form, from croup. Indeed in the early stages it is often impossible to differentiate the two affections. In young children, from the small size of the larynx, and the great tendency to reflex irritation, slight inflammation of the larynx quickly gives rise to spasm, and produces stridulous breathing, *laryngitis stridulosa;* as it is technically called. When, however, the disease is fully developed, the two affections are easily distinguished, for whilst catarrhal laryngitis nearly always ends in recovery, in diphtheria the prospect of a fatal termination is soon apparent. Croup very often commences at night, but catarrhal laryngitis almost invariably comes on at that time; hence we have in the time at which the disease first manifests itself a possible diagnostic sign. It has already been pointed out that the laryngoscope cannot often be successfully used in young children, but the expectoration must be examined in the way already described, and false membrane, if present, will always be detected.

Further, there is a pure neurosis, a spasmodic action of the adductors of the vocal cords, giving rise to *laryngismus stridulus*, which has been called "spurious croup," "false croup," and "nervous croup," with which true croup is sometimes confounded. This disease very frequently comes whilst the mother is suckling, or dandling the child. Carpo-pedal contractions also occur in marked cases of laryngismus, but above all there is *the absolute intermission* of all dyspnœa between the paroxysms; whilst in true croup, when fully established, slight dyspnœa is always present between the attacks of suffocation. Many fatal cases of laryngismus, however, no doubt lose their qualitative affix and appear in the Mortality Returns as simple "croup."[1]

*Pathology.*—The false membrane does not differ essentially from that described in connection with the pharyngeal form of the disease. The membranous exudation is more frequently found on the epiglottis and the ary-epiglottic folds than on the lower portions of the larynx, but occasionally it invests the whole of the lining membrane of the larynx, extends throughout the ventricles, and passes along the trachea to the smallest ramifications of the bronchi. It rarely happens that the lymph is so abundant as to completely occlude the larynx, and in many fatal cases only a very thin, transparent membrane is found. The dyspnœa in croup is primarily due

[1] The above considerations tend to show that the substantive use of the word "croup" is altogether objectionable.

to the inflammatory tumefaction and plastic exudation, which, however, soon gives rise to spasm of the adductors. The muscles are infiltrated with serum, but there is no paralysis of the abductors, nor atrophy of their structure.[1] The lymph is also more closely adherent in the supra-glottic than in the sub-glottic region. On removing the lymph the mucous membrane is generally almost normal below the level of the vocal cords, but above that line it is often swollen and inflamed, and sometimes ulcerated. It has already been stated that the membrane which forms in the trachea can be much more easily detached than that which is found in the pharynx. There is nothing special as regards the false membrane in the trachea, which is generally more adherent in the upper than in the lower portion of the tube.

*Prognosis.*—The prognosis is most unfavourable. Probably not more than 10 per cent. of the patients recover under suitable treatment without tracheotomy. In this country tracheotomy is, comparatively, so little practised in croup—in proportion to the number of cases—that nearly all the remainder prove fatal. If, however, the remaining 90 per cent. were tracheotomized, 66 per cent. might recover according to the most favourable statistics (see Note 3, page 183), or, according to an average, based on 4,663 operated on in the Children's Hospitals of Paris, 23·91 per cent. Accepting the latter figures, out of 100 cases of undoubted croup we might expect that 68·49 would terminate fatally, and 31·51 recover—10 without tracheotomy and 21·51 (*i.e.*, 23·91 per cent.) after the operation. If the trachea were not opened in the proper proportion of cases the fatality would, of course, be proportionately greater; whilst if the operation were performed earlier than is commonly the case, the mortality would probably be considerably less. The fatal termination may be expected in the first three or four days, certainly within the first week.

*Treatment: First Stage.*—The child should be placed in a warm, well-ventilated room, an ice-bag should be applied to the neck, and ice constantly sucked. Spray inhalations of lactic acid (℥xx ad ℨj.) should be employed. The inhalations should be given at least every hour, and continued for five minutes at a time. In *the second stage*, or as soon as it is believed that false membrane has formed, emetics must be employed. A number of instances are recorded in which children have been saved from imminent asphyxia by the spontaneous expulsion of false membrane, and this

[1] See an interesting case recently published by Dr. Baginsky: "Central. Zeitung für Kinderheilkunde," October 1, 1878.

natural mode of cure has sometimes been happily imitated by the administration of emetics. According to Valleix,[1] in thirty-one cases so treated, fifteen recovered, whilst of twenty-two in which this class of remedies was neglected, only one cure resulted. Trousseau concurs with the statements of Valleix. In many cases, however, the relief is merely temporary, the membranes quickly reforming in the larynx, and the dangerous symptoms returning with increased severity. Moreover, the practice is not altogether unattended by danger, for, the tracheal membrane may be forced up by the act of vomiting in such a way as to entirely obstruct the passage of air. This risk must be incurred, though valuable time should never be wasted on the use of emetics, when the only alternative is the performance of tracheotomy. Tickling the fauces will occasionally be sufficient to excite the desired action, but as a rule it is necessary to resort to drugs. Cardiac depression is so common an accompaniment of diphtheria that it is unwise to employ any emetic by which it is likely to be increased. Tartar emetic must, therefore, be especially avoided. Strange as it may seem, this drug has in times past been very widely employed in diphtheria. Trousseau,[2] indeed, strongly condemned its use, terming it the most dangerous of all emetics. But Bouchut,[3] as late as 1859, published three cases in which he attributed a successful issue to the energetic employment of tartar emetic. His example should not be followed, especially as we have at our command emetics which are not less certain in their action than antimony. Should the practitioner distrust the efficacy of ipecacuanha, it is quite open to him to add from fifteen to twenty grains of sulphate of zinc. If the administration of these agents is not quickly followed by vomiting and the expulsion of the membrane it is useless to repeat them, and even where the breathing has once been temporarily relieved by their use, it is very questionable whether they should be again employed. In no case should the physician place too much reliance upon them.

When it is judged that there is false membrane loose in the larynx, the removal of the membrane by direct mechanical means should be attempted. The best instrument used for this purpose is a brush attached to a piece of soft aluminium wire. Instead of the common laryngeal brush I use one

[1] "Guide du Méd. Prat." t. i. Art. "Diphthérite."
[2] Trousseau: Op. cit. vol. ii. p. 578.
[3] "L'Union Médicale," April 5th, 1859.

made of squirrel's tail. *The hairs cover the sides of the laryngeal portion of the brush*, and are directed upwards. As the laryngoscope cannot generally be used, the brush, guided by the forefinger of the left hand, should be carried down into the interior of the larynx. The windpipe can generally be freed from exudation by to-and-fro movements combined with a certain amount of rotation. I have several times employed this brush with marked advantage. Even if the practitioner is successful, however, in detaching portions of membrane, fresh exudation often recurs.

I must here briefly refer to the subject of catheterism and "tubage" of the larynx. Catheterism was first recommended by Loiseau,[1] as a means of removing false membrane and introducing remedies into the windpipe. I have only to say that the false membrane can be much more easily removed with a proper croup-brush, and that solutions or powders can be more readily applied with a common laryngeal brush or insufflator. "Tubage," introduced by Bouchut,[2] consists in the introduction of a small tube, from three-quarters of an inch to an inch in length, and leaving it in the larynx. It causes so much irritation that it cannot be retained, and its use has been quite given up.

*It is at the close of the second stage of croup, when inhalations and emetics have failed, that tracheotomy is called for.* Marked recession of the sternum and chest walls is the indication for its performance. The credit of having been the first to establish this operation on a secure basis as a justifiable part of the treatment of croup is due to Bretonneau,[3] who published his first successful case in July, 1825. Ten years later Trousseau[4] reported that he had performed the operation thirty-six times with nine recoveries. From this time the position of the operation was secured, and it has since been performed many thousand times in France alone. Before his death, Trousseau[5] published a series of 466 cases in which the operation had been performed in the Children's Hospital in Paris, between the years 1849 and 1858. Of these, in spite of unfavourable surroundings, 126, or more than 1 in 4, recovered. Later statistics have given still more favourable results. In 1863, Fischer and Bricheteau[6]

[1] "Bull. de l'Acad. de Méd." 1857. [2] Ibid. Sept. 1858.
[3] Bretonneau: "Memoirs" (New Syd. Soc.), p. 59.
[4] Trousseau: Ibid. p. 243.
[5] Trousseau: "Rapport à l'Acad. de Méd."—"Bull. de l'Acad. de Méd." vol. xxiv. p. 112.
[6] "Nouveau Dictionnaire de Médecine et Chirurgie." 1869, vol. x. p. 368.

collected all the facts within their knowledge at the Hôpital des Enfants Malades, the Hôpital Sainte Eugénie, and in the city and the provinces, and the general results were as follows :—At the Hôpital des Enfants Malades the operation had been performed in 1,011 cases, and the proportion of recoveries was 1 in 4; at the Hôpital Sainte Eugénie the proportion was 1 in 6; while the facts collected from other sources, though confessedly incomplete, showed in Paris 1 cure to 2·6 cases, and 1 to 3·6 in the provinces. According to M. Sanné, however, who has published the most extensive statistics from the Paris hospitals, during recent years the proportion of recoveries after tracheotomy has been less favourable, especially at the Hôpital Sainte Eugénie, as will be seen from the appended tables [1] :—

HÔPITAL SAINTE EUGÉNIE.

| Years. | Operations for Croup. | | | | Proportion of Cures. |
|---|---|---|---|---|---|
| | Discharged Cured. | Dead. | Left uncured. | Total. | |
| 1854.... | 2 | 7 | 0 | 9 | 1 in 4·50 |
| 1855.... | 4 | 9 | 0 | 13 | 1 ,, 3·25 |
| 1856.... | 5 | 19 | 0 | 24 | 1 ,, 4·80 |
| 1857.... | 5 | 24 | 1 | 30 | 1 ,, 6·0 |
| 1858.... | 23 | 95 | 4 | 122 | 1 ,, 5·29 |
| 1859.... | 17 | 88 | 4 | 109 | 1 ,, 6·41 |
| 1860.... | 7 | 31 | 2 | 40 | 1 ,, 5·71 |
| 1861.... | 16 | 45 | 3 | 64 | 1 ,, 4·0 |
| 1862.... | 23 | 67 | 7 | 97 | 1 ,, 4·21 |
| 1863.... | 35 | 68 | 3 | 106 | 1 ,, 3·02 |
| 1864.... | 26 | 85 | 4 | 115 | 1 ,, 4·42 |
| 1865.... | 44 | 87 | 6 | 137 | 1 ,, 3·11 |
| 1866.... | 36 | 76 | 3 | 115 | 1 ,, 3·19 |
| 1867.... | 29 | 63 | 4 | 96 | 1 ,, 3·31 |
| 1868.... | 31 | 101 | 3 | 135 | 1 ,, 4·35 |
| 1869.... | 31 | 70 | 2 | 103 | 1 ,, 3·35 |
| 1870.... | 42 | 85 | 4 | 131 | 1 ,, 3·11 |
| 1871.... | 12 | 78 | 3 | 93 | 1 ,, 7·75 |
| 1872.... | 39 | 138 | 10 | 187 | 1 ,, 4·79 |
| 1873.... | 32 | 170 | 11 | 213 | 1 ,, 6·65 |
| 1874.... | 23 | 132 | 7 | 162 | 1 ,, 7·04 |
| 1875.... | 27 | 175 | 9 | 211 | 1 ,, 6·48 |
| | 509 | 1713 | 90 | 2312 | 1 in 4·54 |

[1] The results at this hospital for the first nine months of 1876 were still more unfavourable, the proportion of cures being only 1 in 8·31. This steady increase in the mortality after tracheotomy is attributed by M. Moizard (Thèse de Paris, 1876, No. 493), partly to the progressive extension of the operation to more and more hopeless cases, and partly to the more malignant character of the disease in Paris during recent years.

## HÔPITAL DES ENFANTS MALADES.

| Years. | Operations for Croup. | | | | Proportion of Cures. |
|---|---|---|---|---|---|
| | Discharged Cured. | Dead. | Left uncured. | Total. | |
| 1851.... | 14 | 17 | 0 | 31 | 1 in 2·21 |
| 1852.... | 18 | 43 | 0 | 61 | 1 ,, 3·38 |
| 1853.... | 9 | 52 | 0 | 61 | 1 ,, 6·77 |
| 1854.... | 14 | 29 | 0 | 43 | 1 ,, 3·07 |
| 1855.... | 12 | 34 | 0 | 46 | 1 ,, 3·83 |
| 1856.... | 16 | 33 | 3 | 52 | 1 ,, 3·25 |
| 1857.... | 16 | 54 | 0 | 70 | 1 ,, 4·37 |
| 1858.... | 34 | 73 | 2 | 109 | 1 ,, 3·20 |
| 1859.... | 41 | 115 | 4 | 160 | 1 ,, 3·90 |
| 1860.... | 24 | 101 | 3 | 128 | 1 ,, 5·30 |
| 1861.... | 29 | 72 | 1 | 102 | 1 ,, 3·49 |
| 1862.... | 27 | 112 | 6 | 145 | 1 ,, 5·37 |
| 1863.... | 46 | 86 | 10 | 142 | 1 ,, 3·08 |
| 1864.... | 40 | 105 | 8 | 153 | 1 ,, 3·82 |
| 1865.... | 40 | 86 | 4 | 130 | 1 ,, 3·25 |
| 1866.... | 27 | 71 | 3 | 101 | 1 ,, 3·74 |
| 1867.... | 15 | 57 | 4 | 76 | 1 ,, 5·06 |
| 1868.... | 26 | 36 | 0 | 62 | 1 ,, 2·38 |
| 1869.... | 12 | 54 | 0 | 66 | 1 ,, 5·50 |
| 1870.... | 21 | 43 | 0 | 64 | 1 ,, 3·04 |
| 1871.... | 16 | 27 | 0 | 43 | 1 ,, 2·67 |
| 1872.... | 30 | 71 | 9 | 110 | 1 ,, 3·66 |
| 1873.... | 26 | 79 | 2 | 107 | 1 ,, 4·11 |
| 1874.... | 23 | 81 | 4 | 108 | 1 ,, 4·69 |
| 1875.... | 38 | 130 | 13 | 181 | 1 ,, 4·76 |
| | 614 | 1661 | 76 | 2351 | 1 in 3·82 |

At the Hospital for Sick Children in the twelve years 1864 to 1876, sixty cases of croup and diphtheria were operated on. Of these thirteen, or 21·6 per cent., were successful. According to Krönlein's[1] recent statistics at the Hospital in Berlin the percentage of cures after the operation was 30.[2] This was the result of 567 operations performed between January 1, 1870, and July 30, 1876, in Professor Langenbeck's clinic. By selecting the best individual series of statistics, for the most part from private practice, Dr. Solis Cohen[3] has brought together 166 cases of tracheotomy in croup with 110 recoveries!

[1] "Langenbeck Archiv.," Bd. xxi. hft. ii.

[2] See also Hüter: "Laryngotomie und Tracheotomie," Pitha-Billroth's Chirurgie, vol. iii. part i. Nro. 5, p. 26, et seq.

[3] "Croup in its Relation to Tracheotomy." Philadelphia, 1874.

Considering the enormous mortality of laryngeal diphtheria, even the most unfavourable figures prove that in such cases tracheotomy is not only justifiable, but that it is a positive duty. The chief questions to be considered in connection with the operation are what are the indications, and what is the best period for its performance?

The cases most favourable for the operation are those in which the symptoms of general infection are slight or absent, and the strength of the patient is unimpaired. It is where the patient has still some vigour, where the pulse is strong and regular, the powers of assimilation good, and the asphyxia, though very marked, is not yet too advanced, that tracheotomy becomes most imperative. In such cases there can be no doubt that the operation has saved, and doubtless will still save, many thousands of lives. It is now generally admitted that tracheotomy should be performed without delay, as soon as it has become clear that it is impossible to relieve the asphyxia by other means. It is clear that an early insertion of the canula gives the patient a much better chance of recovery than when there is a long delay; and it is owing to the disregard of this fact that tracheotomy in diphtheria has in some quarters acquired such an evil repute. For the description of the operation, and the precautions which must be taken in performing it, I must refer the reader to the article on Tracheotomy, but I would here call attention to the extreme importance of endeavouring, immediately after the operation, to draw out any loose false membrane, either with the croup-brush or an aspirator accurately applied to the mouth of the canula. The after-treatment is very important, and the patient requires most assiduous attention for some days. The temperature and due moisture of the room must be carefully maintained, the tube must be constantly watched, and freed from secretions or pieces of ejected membrane, and the wound must receive daily attention. At the same time the administration of food and stimulants must be the subject of the greatest care and regularity, and antiseptic sprays should be administered through the canula. The chief dangers to be feared in the after-treatment of tracheotomy are extension of the exudation into the bronchi, occlusion of the tube, and failure in the innervation of the lungs. The effects of extension of the membrane may in some cases be averted by removing the tube, and extracting fragments of lymph from the trachea with forceps, or with the croup-brush. Long strips of exudation,

and in rare cases almost entire casts of the windpipe have been removed in this way. Occlusion of the tube is only to be prevented by placing the patient under the charge of a trustworthy attendant, who will not fail in cases of emergency to remove the canula and free the passage.

*In the third stage* tracheotomy remains the only hope of saving the patient's life. If the operation has unfortunately not been performed in the second stage, the chance of success is very much diminished. The operation is not contra-indicated, however, even when the apnœa is extreme, and the patient is apparently on the point of suffocation, provided only that the heart's power is still good. In some cases the patient has been saved by it when literally at the last gasp. Such instances, however, are quite exceptional. Some authorities have maintained that even in quite hopeless cases, where the patient is dying from dyspnœa, tracheotomy should be performed with the view of promoting the euthanasia. It is true that death from syncope or gradual exhaustion is much less painful than death from apnœa, and it may be advisable to secure this substitution by a surgical operation. But it is not in these cases that tracheotomy finds its really valuable application. When it is found on auscultation, that air enters one lung and does not penetrate the other, it is clear that the false membrane has extended down one bronchus, and tracheotomy is then much less likely to be of any use. In the same way, if extensive pneumonia has supervened the operation is likely to be of little benefit. Where the patient is already dying of cardiac failure or exhaustion, it is of course in vain to attempt to save life by the surgical operation.

## NASAL DIPHTHERIA.

In some epidemics of diphtheria the disease commences with nasal catarrh, and this phenomenon was so common in the epidemics witnessed by Bretonneau, that he regarded it as the common course of the disease. Further experience, however, has demonstrated that catarrh of the nose is far less usual than it was at one time supposed, and that true nasal diphtheria is generally due to the extension of the plastic inflammation from the pharynx. The disease commonly first shows its presence by an unhealthy brown ichorous discharge, which causes abrasion, and even ulceration, of the skin in the neighbourhood of the nostrils. Soon afterwards the parts

are covered with false membrane which can be seen extending through the nose. At other times the false membranes do not reach the external orifice, but, on using the speculum, a few scattered deposits of lymph can be perceived on the mucous membrane of the septum or the turbinated bones. The false membrane, however, is generally most abundant at the posterior nasal orifices.

In this form of diphtheria it is especially necessary to endeavour to prevent the products of the disease from accumulating and putrefying in the nasal cavities, for experience has shown that, under such circumstances, they are extremely liable to be absorbed and to lead to secondary septic poisoning. It is all-important, therefore, to keep the passages as clear as possible, by the use of astringent or solvent liquids. With this object, weak solutions of alum, tannin, carbolic acid, permanganate of potash, or lactic acid, should be repeatedly syringed over the affected parts. If epistaxis occurs, as it frequently does in nasal diphtheria, an astringent snuff or lotion is usually sufficient to arrest it. Plugging the nares should, if possible, be avoided.

*** The various features of Diphtheria are discussed in slightly greater detail in my recent work, entitled, "Diphtheria: its Nature and Treatment." Churchill, 1878.

## THE THROAT AFFECTIONS OF THE ERUPTIVE FEVERS.[1]

(Scarlatina, Measles, and Small-Pox.)

*Latin Eq.*—Morbi gutturis inter exanthemata (Febrem rubram, Morbillos, Variolam).

*French Eq.*—Maladies de la gorge dans les fièvres éruptives (Scarlatine, Rougeole, Variole).

*German Eq.*—Die symptomatischen Halsaffectionen bei den acuten Exanthemen (Scharlachfieber, Masern, Blattern).

*Italian Eq.*—Le malattie della gola negli esantemi (Febbre scarlatina, Rosolia, Vajuolo).

Definition.—*Morbid phenomena manifested in the mucous membrane and subjacent structures of the pharynx and larynx during the course of scarlatina, measles, and small-pox.*

[1] As the pharynx and larynx are so frequently affected together in the acute exanthemata, I have thought it better to treat all the local manifestations in this section.

## Scarlet Fever.

The mucous membrane of the *pharynx* is generally affected in scarlatina, and in some cases the pharyngeal enanthem appears to constitute the only local expression of the disease. Although the skin eruption of this fever often comes out on the second day, that is, the day after chilliness, vomiting, and headache have occurred, in most cases soreness of the throat is the first symptom complained of.

In *Scarlatina Simplex* little or no redness can be seen on examination, and there is only slight aching or stiffness, which ceases in a day or two from the commencement of the attack.

In *Scarlatina Anginosa*, great soreness of the throat is a marked feature of the disease. On inspecting the pharynx the whole of the mucous membrane is seen to be of a deep red or even violet hue, and as the fever develops considerable internal and external tumefaction of the tissues takes place. The tonsils, and the sub-maxillary and parotid glands, are implicated in the morbid process, and in many cases all the structures of the neck become the seat of a violent phlegmonous inflammation, terminating at one or more parts in abscess. At this stage of the malady, viz., the third or fourth day of the attack, the mucous membrane of the pharynx generally becomes covered with a quantity of whitish pultaceous exudation. The subjacent epithelium is often partially destroyed, giving rise to shallow abrasions; but deep ulceration is very seldom present. In some cases resolution takes place at this stage; the swelling becomes reduced, and the tissues soon regain their normal condition. In the worst instances, however, suppuration occurs in the cellular tissue or glands of the neck, and large abscesses form, which usually burst externally, near the angle of the jaw, though sometimes they burrow downwards as far as the clavicle. After all the specific symptoms of the fever have disappeared, such cases frequently prove fatal from the exhaustion caused by copious and long-continued discharge of pus. During the progress of this form of scarlet fever the disease sometimes extends to the *larynx*, when the voice is modified, and, if the epiglottis is much inflamed, deglutition becomes difficult, and liquids regurgitate through the nose. Some difficulty of breathing may also be present, but as Trousseau[1] observes, "scarlatina does not like the

[1] "Clin. Med. de l'Hôtel-Dieu." Paris, 1865, vol. i. p. 105.

larynx," and suffocation from œdema of the glottis is a rare issue of the complaint.

In *Scarlatina Maligna* the characteristic phenomenon is secondary diphtheria.[1] In these cases the pharyngeal lesion is more tardy in its appearance, and the patient often seems at first to suffer from a mild attack of the malady. About the ninth day, when the eruption has disappeared and the feverish symptoms have abated, the disease attacks the pharynx, and in a few hours swelling takes place in the glands at the angle of the jaw. The tonsils and fauces are covered with diphtheritic exudation, a fetid sanious discharge proceeds from the nares, and the breath becomes tainted with a foul odour. Occasionally the morbid process extends to the larynx, and this has been noticed to occur more frequently in some epidemics than in others. Gupp[2] described an epidemic in Würtemberg in which, in the greater number of cases, croupy symptoms appeared from the third to the fourth day of the illness; and in some cases death took place before the exanthem appeared. As in primary diphtheria, on separation of the lymph, ulceration of the mucous membrane is often found. A characteristic specimen of ulceration (No. 36, Series W.) is contained in the Museum of St. Thomas's Hospital. The larynx, which was taken from an adult patient who died of scarlatina, has a very thin layer of lymph covering the entire mucous membrane, and the right arytenoid cartilage is laid bare by a large ulcer. Gangrene not unfrequently attacks the pharynx, larynx, and œsophagus, the pulse becomes weak, the surface of the body is blanched and cold, collapse supervenes, and the patient dies in a state of coma.[3] In some cases large vessels are opened by the ulcerative process, and death occurs from hæmorrhage. A somewhat rare complication of the malignant form of scarlet fever, "scarlatinal buboes," requires some mention. They are situated principally in the glands of the neck, which become suddenly inflamed about the tenth or twelfth day, and in five or six days a large abscess is formed. Sphacelus of the surrounding cellular

[1] See Fuchs: "Historische Untersuchungen über Angina Maligna und ihr Verhältniss zu Scharlachfieber und Croup." Würzburg, 1828.

[2] Rühle: Op. cit. p. 243.

[3] See Graves: "Clinical Lectures on the Practice of Medicine." Lect. xxii. Dublin, 1848.

tissue may take place, and Graves[1] and Trousseau[2] report cases in which the muscles of the neck were laid bare, and the carotids could be seen pulsating at the bottom of the wound.

*Diagnosis.*—The recognition of the scarlatinal nature of the angina is principally based on the existence of the skin eruption during some period of the illness. The suddenness of the attack, the intensity of the accompanying fever, the deep red or violet tinge of the pharynx, and the occurrence at the same time of an epidemic of scarlet fever, all tend to assist in the diagnosis; but when the pathognomonic exanthem is absent some uncertainty must often remain as to the true nature of the malady. In such cases the subsequent development of dropsy and albuminuria occasionally sets any doubt at rest.

*Prognosis.*—The local affection is itself often a cause of death, and as the throat-manifestations of scarlet fever are the expression of the intensity of the general blood-poisoning, they furnish an important indication as regards the constitutional condition. In scarlatina simplex the local affection is unattended with danger. Scarlatina anginosa probably results in death in about one-fourth of the persons attacked, whilst in the diphtheritic form about half the patients die.[3]

*Treatment.*—Local measures are of but little use in the treatment of the anginæ of scarlet fever. Trousseau[4] advises the application of hydrochloric acid to the throat, when it presents a pultaceous or gangrenous aspect. The dilute acid has also been administered internally, on the supposition of its possessing a specific action against the general blood-poisoning. In severe cases a general tonic and analeptic treatment must be adopted, whilst emollient gargles, hot, soothing inhalations, and warm poultices are the only local remedies that can be employed with advantage. The treatment of the plastic form of inflammation should be such as is recommended for primary diphtheria, viz., the internal use and local application of the persalts of iron, a highly nourishing diet, the free use of alcoholic stimulants well diluted, and the employment of antiseptic sprays and solutions. The practitioner must always bear in mind that tracheotomy may be necessary.

[1] Op. cit. vol. i. p. 345.
[2] Loc. cit. p. 107.
[3] Sanné: Op. cit. p. 179.
[4] Loc. cit.

## Measles.

The *pharyngeal affection* of measles is usually of slight importance, as in severe outbreaks of this fever the gravest lesions are manifested in the larynx, trachea, and bronchi. In many cases no eruption takes place on the mucous membrane of the throat, whilst in the great majority of instances, although more or less redness can be seen on inspection of the pharynx, the patient does not complain of any soreness of the throat. The enanthem appears at about the same period of the fever as the exanthem, *i.e.* in the course of the third or fourth day. False membranes may become developed after the subsidence of the general pyrexia, and occasionally even gangrene of some portions of the pharyngeal tissues may occur.[1]

*The laryngeal disease* may be either a simple catarrh, or true diphtheria. The catarrhal form of laryngitis may occur before the exanthem, or a day or two after the rash has come out, but in some epidemics it develops when the eruption has almost disappeared.[2] It is more common than the croupy form of disease, and though occasionally the inflammation runs high, it is seldom of any importance. The principal symptom is obstinate hoarseness. In a number of Professor Hebra's patients in the General Hospital at Vienna, in different stages of measles, Dr. Stofella[3] found a highly injected condition of the mucous membrane of the larynx in almost all the cases which he examined laryngoscopically. "This variety of croup," observes Dr. West, "seldom begins until the eruption of measles is on the decline, or the process of desquamation has commenced. Its occurrence is most frequent from the third to the sixth day from the appearance of the eruption, but it oftener occurs at a later than at an earlier period."[4] Laryngeal diphtheria, or croup, is much more common than pharyngeal diphtheria. The prognosis is more unfavourable than in scarlatinal diphtheria, 80 per cent. of the cases terminating fatally.

*Treatment.*—No special treatment is required for the catarrhal affection, as spontaneous resolution takes place in seven or eight days. In the presence of false membrane, mortification, or collapse, the same measures must be adopted

[1] See Barthez and Rilliet: "Traité des Maladies des Enfants," Paris, 1853.

[2] Bohn: "Königsberger Medizin. Jahrbücher." 1852.

[3] "Wien. Medizin. Wochenschrift," Nos. 18, 19, 20. 1862.

[4] Op. cit. p. 448.

as recommended in the articles on diphtheria, croup, and putrid sore throat.

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## Small-Pox.

From the third to the sixth day of the eruption of variola the *mucous membrane of the pharynx* often becomes the seat of a crop of pustules similar to those on the skin. In quantity they correspond, to some extent, to the abundance of the exanthem, and in severe cases they cause considerable inflammation and tumefaction in the throat, together with great pain in swallowing. Pustular sore throat, as Trousseau[1] remarks, is also often accompanied by ptyalism, whereas in scarlatina this symptom is almost always absent. Ulcerations of sufficient depth to lay bare the muscular tissues occasionally occur in the malignant forms of confluent small-pox.

*The laryngeal affection* may be a mild papular or pustular eruption of the mucous membrane, which causes little or no inconvenience, or it may be a diphtheritic process, which is often fatal. In the year 1863, through the courtesy of Mr. Marson, I was enabled to examine several patients in the Small-pox Hospital with the laryngoscope. In one patient labouring under severe purpuric small-pox, I found ecchymotic spots on the under surface of the epiglottis and on the mucous membrane over the arytenoid cartilages. In a convalescent case there was a distinct pustule on the edge of the epiglottis; in another instance, in which the entire body was covered with pustules, the larynx appeared perfectly healthy; and in another similar example there were no pustules, but there was marked congestion of the mucous membrane; in another instance the upper surface of the epiglottis was covered with pustules. Trousseau[2] mentions the circumstances of three cases that came under his own observation, where death took place from suffocation. "Three patients," he observes, "had arrived at the eleventh day of a variola, which up to that time had pursued a normal course. Suddenly they were seized by a frightful attack of suffocation, which carried them all off before sufficient time had elapsed for any one to come to their assistance. In one of these individuals, traces were found at the autopsy of inflammatory lesions of the larynx and pustules of small-pox below the glottis." In

[1] Loc. cit. p. 15, et seq. [2] Ibid. p. 16.

another case[1] the post-mortem discovered œdema of the ary-epiglottic folds, with an abscess as large as a pigeon's egg between the œsophagus and larynx. Rühle, who witnessed a bad epidemic of small-pox in Greifswald, in 1856–57, and who made no less than fifty-four post-mortem examinations, observes,[2] "Although I have seen here and there pustule-like elevations, I nevertheless consider the essential peculiarity of the laryngeal affection to be a croupous or diphtheritic inflammation." This author adds that as "out of the fifty-four cases there was not a single instance in which the larynx and windpipe were in a normal state, he cannot but attribute a certain proportion of the mortality to the laryngeal affection." Pathological examples of the diphtheritic complications of small-pox are to be found in the museums of St. Thomas's and St. Bartholomew's Hospitals and in other collections. In two instances I have known permanent paralysis of the adductor of a vocal cord follow small-pox; in both of these the larynx was affected at the time, and it is probable that the affection was of the diphtheritic character.

*Treatment.*—In the milder class of cases, emollient gargles and weak astringent applications are useful. Suffocative attacks, dependent on œdema, must be met by scarification of the larynx, and in the worst cases by tracheotomy. In the diphtheritic form of disease treatment is almost useless, but the local remedies elsewhere recommended for primary diphtheria should be adopted.

## THE THROAT AFFECTIONS OF TYPHOID FEVER.

*Latin Eq.*—Morbi gutturis inter febrem entericam.
*French Eq.*—Maladies de la gorge de la fièvre typhoïde.
*German Eq.*—Halsaffectionen beim Abdominaltyphus.
*Italian Eq.*—Le Malattie della gola nella febbre tifoide.

Definition.—*The throat affections of typhoid fever are of two kinds—(a) a low type of inflammation of the mucous membrane of the pharynx or larynx, leading in the latter situation to deep ulceration; and (b) secondary diphtheria.*

The *pharynx* is not invariably affected in enteric fever, the blood-poison more frequently provoking an attack of bronchitis or pneumonia. The mildest and most frequent

[1] Ibid. p. 20 [2] Op. cit. p. 247.

form of pharyngeal lesion consists in a simple erythema of the mucous membrane of the mouth and fauces; and subjectively the affection occasions but little inconvenience beyond a dryness of the throat, and slight soreness in swallowing. The parts gradually regain their natural condition as the convalescence of the patient becomes established. Occasionally an herpetic eruption is seen on the mucous membrane of the pharynx and mouth, which is attended by considerable pain in deglutition. This affection, which is only an accidental complication, though more severe than the erythematous condition, like it also undergoes spontaneous resolution, without leaving any ill effects.

Secondary diphtheria is accompanied by the physical appearances and symptoms of the primary affection.[1] When this complication occurs in typhoid fever the prognosis is most unfavourable. Thus out of six cases mentioned by Oulmont,[2] five terminated in death; whilst Peter[3] states that all the instances he has met with have proved fatal.

In *the larynx*, as in the pharynx, both the inflammatory and the diphtherial affections are met with. The inflammatory changes have, as Dr. Wilks[4] has pointed out, a great disposition to end in ulceration. According to Heinze,[5] out of 113 cases of typhoid fever examined at the Pathological Institution at Leipzig there were 13 cases of ulceration of the larynx. The ulceration sometimes involves a considerable surface, but it more frequently penetrates deeply and exposes the cartilages. It is generally at the posterior parts of the larynx, that is, *at the under part* in the prone position of a patient suffering from fever, that the disease is most frequently found; and it is commonly thought to be caused, at least in part, by hypostatic influences. Frequently, however, the sides of the epiglottis and the inter-arytenoid folds are ulcerated, and the disease in this situation has been attributed to friction. The cricoid cartilage is often seen to be denuded, and of a blackish grey colour; and there is generally a corresponding discoloration of the opposite wall of the pharynx. There is some liability to œdema, but the ulcerative process more often appears to

[1] See a paper entitled "Pharyngotyphus," in Günburg's "Zeitschrift." 1850, p. 155.
[2] "Act. de la Soc. des Hôp." 1859, 4e fasc. p. 30.
[3] "Dict. des Sc. Méd." Paris, 1864, vol. iv. p. 736.
[4] "Trans. Path. Soc." vol. ix. p. 34, and vol. xi. p. 14.
[5] "Die Kehlkopfsschwindsucht." Leipzig, 1879.

originate in a typhous deposit—"laryngo-typhus being," as Rokitansky says, "the completion, as it were, of abdominal typhus." Tobold[1] states that the typhoid ulcer "commences in the mucous membrane as a circumscribed spot of congestion, which soon becomes yellow and depressed, sinks into the tissues, and losing its epithelium, constitutes the decubital-ulcer. From absorption of tissue the small ulcers gradually attain the size of a bean, and generally have irregular discoloured edges." It is said that the cartilages often become independently diseased, *i.e.*, become affected without the superjacent tissues being primarily involved. So many conditions of the larynx, however, are met with which tend to the destruction of the cartilages that it seems unnecessary to resort to the theory that these structures are independently diseased. The further pathological changes will be found described under "Perichondritis of the Larynx." Secondary diphtheria is not uncommon in typhoid fever, but from the unconscious condition of the patient it is very often overlooked during life, and only discovered at the post-mortem examination. Though it most frequently commences in the larynx, and is often confined to that part, the diminished supply of air causes little inconvenience, owing to the medulla having, to a great extent, lost its sensibility to impressions. The obstruction to respiration is also less marked, from the fact of the disease, in most cases, attacking adults. Diphtheria rarely occurs before the end of the second week. The prognosis is very unfavourable, the prostrate condition of the patient preventing the use of antiseptic inhalations or local applications.

*Treatment.*—In the catarrhal affection soothing inhalations are useful. In the diphtheritic affection little can be done in the way of treatment, and there remains only the operation of tracheotomy, which in these cases offers little prospect of success.

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## Typhus.

The throat symptoms in typhus are similar to those met with in typhoid fever, but are much more rarely encountered.

[1] Tobold: "Laryngoscopie," &c. Berlin, 1874, p. 207, et seq.

### Intermittent Fever.

Some practitioners make special mention of a sore throat connected with intermittent fever.[1] The affection is said to be characterized by periodicity, and to arise from palustral blood-poisoning. The treatment consists in the administration of quinine, as in cases of ague, the symptoms of which are supposed to be only marked by the local phenomena in the throat. It is, however, by no means certain that an angina of this nature really exists, the evidence forthcoming on the subject being both scanty and inconclusive.

## ERYSIPELAS OF THE PHARYNX AND LARYNX.

*Latin Eq.*—Erysipelas pharyngis et laryngis.
*French Eq.*—Angine erysipélateuse.
*German Eq.*—Erysipelas des Schlundes und Kehlkopfs.
*Italian Eq.*—Risipola della faringe e della laringe.

Definition.—*Erysipelas of the mucous membrane of the pharynx and larynx pathologically similar to the same malady when situated on the skin, and occurring either primarily or by extension from the face along the mucous tracts of the mouth, nose, or ear.*

*History.*—The existence of an erysipelatous affection of the mucous tracts inside the body was recognized as early as Hippocrates,[2] who states: "When erysipelas extends from within outwards it is a favourable symptom, but when it removes to the internal surfaces it is a deadly one. The signs of this occurrence are—disappearance of the external redness, with oppression on the chest, and difficulty of breathing." Subsequent writers studied the phenomena of the retrocession of erysipelas with more topical accuracy, and Fabricius Acquapendente[3] refers to a case of metastasis —a phenomenon of doubtful occurrence. During the eighteenth century many authors gave descriptions of erysipelas of the pharynx with more or less precision; and in 1757, Darluc,[4] in recounting the facts of an epidemic

[1] Peter: Loc. cit.; also Desnos: "Dict. de Méd. et de Chir. Prat." vol. ii. p. 472.
[2] "Coacæ Prenotiones," lib. II. cap. xiv.
[3] "Opera Chirurgica." Pars Prior, lib. I. cap. viii.
[4] "Journal de Méd. et de Pharmacie." Juillet, 1757.

of erysipelas which occurred at Caillan in 1750, expresses himself thus clearly : "In some cases the morbific matter extended to the throat, and caused difficulty of deglutition; the voice became hoarse, with a species of suffocation, swelling in the muscles of the neck, and all the symptoms of quinsy." Finally, in 1862, Cornil[1] almost exhausted the subject in an excellent article containing cases which illustrate nearly every phase of the disease.

*Etiology.*—The causes of erysipelas of the pharynx or larynx are evidently those of the same disease when situated on the external parts of the body. Thus most cases seem to recognize an epidemic or an endemic influence, whilst a small proportion of the instances met with appear to occur sporadically. The etiology with respect to age and sex has not hitherto been established by a sufficient mass of statistics, but according to Cornil,[2] out of eighteen cases in which the pharynx was affected fifteen patients were under the age of thirty, and two-thirds of the cases were females.

*Symptoms.—When the disease is confined to the pharynx* the primary phenomena vary considerably in different cases, and also diverge widely from the first symptoms of simple tonsillar inflammation. Previously to the efflorescence of erysipelas there is a well-marked febrile stage, in which the temperature sometimes rises as high as 104° Fahr. This initiatory fever may last for three or four days before any soreness is felt in the throat or the characteristic redness appears on the skin. In one class of cases—the majority—the pharyngeal disease occurs as an extension of a similar attack on the face, whilst in another the mucous membrane is first affected. Out of eighteen cases analyzed by Cornil,[3] the erysipelas twice appeared simultaneously on the face and in the pharynx, the throat was the primary seat of the disease seven times, and on nine occasions the skin was attacked first. The propagation of the malady from the face to the pharynx and *vice versâ* was observed to take place by four different routes, viz. : (1) Most frequently by the lips and mucous membrane of the mouth ; (2) by the nasal fossæ ; (3) by the Eustachian tube, the middle ear, and the external auditory meatus, and (4) by the nasal fossæ and the lachrymal sac and ducts to the conjunctiva and eyelids. In none of the cases was there any metas-

[1] "Archiv. Générales de Méd." 1862, t. xix. pp. 257, 443.
[2] Ibid. p. 459
[3] Loc. cit. p. 449.

tasis, but the disease spread by continuity of tissue, and the erysipelatous redness could be traced step by step along the paths indicated. In a case reported by Gull[1] the erysipelas spreading from the pharynx reached the face almost at the same time by the auditory and lachrymal channels. I have myself only met with four undoubted cases of erysipelas of the pharynx. In three of these the disease spread from the pharynx to the face—twice by the nose, and once by the mouth and lips. In none of these cases was the diagnosis made out till the erysipelas reached the skin. In the other case the affection commenced in the auricle of the right ear and spread through the Eustachian tube to the uvula and left tonsil. The following were the sexes and ages of my patients: A man aged 58, and three women aged 47, 28, and 17. When the disease arrives at the pharynx the patient complains of pain and difficulty in deglutition. Swelling of the submaxillary and cervical glands is almost constantly present, and to such an extent, that in many cases, the patient can scarcely open his mouth. Stiffness of the jaw from this cause is sometimes complained of before anything can be seen on the skin or in the pharynx, and there is often considerable ptyalism from implication of the parotid and salivary glands. The pharyngeal lesion may terminate in gangrene.[2] In conjunction with so serious a phase of the disease, all the constitutional symptoms are much aggravated, and when mortification takes place the symptomatic fever assumes a low typhoid form, and there is a tendency to death by collapse. On inspecting the pharynx the appearance of the mucous membrane, when affected with erysipelas, differs considerably according to the form of the disease which is present; the local phenomena are always very different from those of tonsillitis, but often cannot be distinguished from simple inflammation of the part. Cornil[3] makes three divisions of the malady, viz., (1) erysipelas with simple redness; (2) erysipelas with phlyctenulæ; and (3) erysipelas terminating in gangrene. Thus it may be seen that erysipelas, when situated on the mucous membrane, tends to pursue a course exactly the same as when it affects the skin. In the first and mildest variety the pharynx presents a diffuse hue of deep purplish red, and has a shining aspect as if the mucous membrane were covered with a varnish. A variable amount

[1] "Medical Gazette," 1849, on the "Alliances of Erysipelas."
[2] Cornil: Loc. cit. p. 453.
[3] Ibid. p. 262.

of œdematous swelling can also be generally perceived. The abnormal coloration extends over the veil of the palate and anterior surface of the uvula, over the pillars of the fauces and tonsils on both sides, and over the posterior wall of the pharynx. When bullæ arise, all the symptoms, both local and constitutional, are increased to an intensity which clearly indicates a severer expression of the disease. The vesicles vary in size from that of a millet seed to a small nut, last but a few hours, and are filled with serum, pus, or even with blood, according to the observations of Cuire.[1] It is often very difficult, except by collateral signs, to distinguish these bullæ from herpes. On their disappearance they leave in their place a whitish yellow patch of softened tissue, which is easily torn from the structures beneath by the act of swallowing or coughing. Under these circumstances, membranous shreds may be seen hanging at various points from the surface of the pharynx. Thus the greater part of the mucous membrane desquamates at the termination of such an attack. After this process has ceased, and all redness and pain have likewise disappeared, an injection of the superficial veins of the pharynx remains for a while, and constitutes for some time the last stage of the morbid action. Most cases terminate in resolution, but in a few instances the intensity of the inflammation has led to gangrene of portions of the mucous membrane and the sub-mucous tissues. The occurrence of mortification can be readily recognized by the characteristic odour, and by the dark, pultaceous appearance of the affected spots of the pharynx. In the four cases which I have seen, recovery took place, though in one instance abscesses formed on the ala of the nose and in the cheek.

Erysipelas most commonly reaches *the larynx* by extension from the pharynx, but the former organ may be primarily affected, whilst the pharynx remains healthy. Porter[2] has described the case of a woman, aged 35, who was admitted into one of the Dublin hospitals, on account of enlarged spleen and anasarca of the extremities. Unfortunately, she was placed in the next bed to a patient convalescent from erysipelas, and in a few days she took that complaint. The left eye first became swollen and the pharynx inflamed, and

[1] "De l'Erysipèle du Pharynx"—"Thèse de Paris." 1864, No. 136.
[2] "Observations on the Surgical Pathology of the Larynx and Trachea." London, 1837, p. 104.

the disease soon extended to the larynx. The patient died comatose, from œdematous laryngitis, three days after the face was attacked. Sometimes the poison of erysipelas confines itself to the larynx, the skin being free from inflammation : at other times it passes from the larynx to the external parts. Cases of the former kind have been already placed on record by Cuire,[1] and another one is now added (see page 201). In erysipelas of the head and neck there is generally more or less congestion of the mucous membrane of the larynx. Occasionally, though less frequently, the affection appears to originate in hospital-gangrene.[2] The symptoms of the disease are difficulty in swallowing, hoarseness or loss of voice, and pain, which is increased on pressure externally. Dr. Semeleder[3] examined four cases of erysipelas of the face, with the laryngoscope, and in all of them he found inflammatory redness and swelling of the epiglottis and larynx down to the vocal cords, though there was no dyspnœa or dysphonia. The inflammatory symptoms in the larynx disappeared gradually with the desquamation of the skin ; and in one case a relapse of the cuticular affection was accompanied by a recurrence of laryngeal inflammation. Sometimes the disease is much more active and may result in an acute œdema, which rapidly tends towards a fatal termination.

According to Peter[4] the malady may extend still further down the respiratory tract, and he states that in one instance he has seen it lead to "galloping consumption."

*Diagnosis.*—The diagnosis of erysipelas of the pharynx and larynx cannot but remain doubtful except where it is accompanied by manifestations on the skin. Indisputable as is the occurrence of erysipelas as an enanthem, there are no pathognomonic signs by which the disease can be recognized when confined to the mucous tracts.

*Pathology.*—Erysipelas consists essentially in a local manifestation on the skin or mucous tracts of a general blood-poisoning. When situated internally, the morbid action is confined to the mucous membrane and sub-mucous tissues. The vessels of the part are loaded with effete elements, and the cellular tissue becomes infiltrated with unhealthy serum. Where gangrene takes place the muscular fibres

[1] Op. cit. pp. 73-77.
[2] Ryland: "Diseases of the Larynx," p. 8.
[3] Loc. cit.
[4] "Dict. des Sciences Méd." Paris, 1866, vol. iv. p. 723.

are softened and separated, but their substance is seldom destroyed. The course of the malady is too rapid for the process of sphacelus to extend deeply. In a case examined by Cornil,[1] where the larynx had become affected, the ary-epiglottic folds were reduced to a mass of "*putrilage*," but the cartilages were left intact. In another case reported by the same author, gangrene of the palate and death having supervened, the autopsy revealed softening of all the superficial structures of the pharynx. The mucous membrane was in several places reduced to a pulp, and the uvula was torn from the soft palate by a slight effort of traction.

*Prognosis.* — The local lesions occasioned by erysipelas are usually subordinate to the severity of the general blood-poisoning. The intensity of the constitutional phenomena must guide us in giving a prognosis as to the probable termination of the attack. The dictum of Hippocrates, already referred to, has been confirmed by modern observation. Thus in nine cases analyzed by Cornil,[2] where the face was first attacked, seven deaths occurred, whereas in nine other instances where the enanthem preceded the skin eruption, seven recoveries took place. The extension of erysipelas to the throat marks an increased intensity of the blood-poisoning, and in the majority of cases the disease is not limited to the pharynx. It spreads down the windpipe and œsophagus, and by giving rise to œdema of the glottis, capillary bronchitis, and lesions of the alimentary canal, tends to a fatal issue.

*Treatment.*—Both local and constitutional measures must be adopted in erysipelas of the throat. As regards topical applications, I have seen benefit result in two cases of pharyngeal erysipelas from the insufflation twice daily of morphia (gr. $\frac{1}{4}$) diluted with starch, whilst ice was constantly sucked and bromide of potassium given every four hours. Hot soothing inhalations should not be used as long as there is any chance of arresting the inflammation. Should the disease terminate in gangrene, we must resort to antiseptic gargles of permanganate of potash, chlorate of potash, carbolic acid, &c., whilst if œdema of the glottis become developed, recourse must be had to scarification of the larynx, and in extreme cases to tracheotomy. Perchloride of iron should be administered internally, and if the vital powers sink low, bark and ammonia, with a free allowance of stimulants, will be

[1] Loc. cit. p. 446. [2] Loc. cit. p. 458.

required. The diet throughout the whole course of the disease should be of the most nutritive description.

The following case illustrates the rare form of the disease in which the larynx is affected with erysipelas, whilst the pharynx and skin are unaffected :—

## ERYSIPELAS OF THE LARYNX; LARYNGOTOMY—DEATH.

(Reported by Dr. Porter, now of St. Louis.)

"James S——, aged 35, a strong, vigorous man, was admitted into the London Hospital, January 19, 1874, for fracture of the right internal malleollus. For ten days the patient did very well, but then complained of pain in the throat and hoarseness. On the following day there was some dyspnœa, whilst the pain and hoarseness were more marked. His temperature was 102°, pulse 132, and respirations 36 to the minute. A laryngoscopic examination on the succeeding day discovered that the mucous membrane of the epiglottis and of the arytenoid cartilages was acutely inflamed. The ventricular bands were so much swollen as to cover the vocal cords. The patient was aphonic and the pain very intense. There was only very slight pharyngeal congestion. Inhalations of benzoin and mild astringent applications were used, and warm fomentations were applied to the neck. Dr. Morell Mackenzie saw the patient the next day, and found great tumefaction of the epiglottis, the mucous membrane of which was thickened and eroded. In consequence of the general swelling the vocal cords could scarcely be seen. The outer side of the neck was also somewhat tumefied. During that evening the patient became rapidly worse. Pulse 160; respirations 44 to the minute and laboured; temperature 103°.

"Laryngotomy became necessary early in the night. There was considerable hæmorrhage, but the patient appeared very much improved by the operation. On the next morning, a dark flush was seen around the tracheal wound; breathing was again difficult and dysphagia increased. There was a distinct friction sound at the apex of the heart, and dulness at the bases of both lungs. The following day the patient was much worse, and the flush around the wound had increased in size and density. The dyspnœa was more marked, and the dysphagia so great that no nourishment could be taken. Death ensued at ten o'clock that evening. [There were two cases of erysipelas in the same ward when the patient was admitted, and several of the attendants of the patients were subsequently attacked with sore throat.]

"The *autopsy* showed that the heart was healthy, but the lungs were œdematous and of a dark colour. The larynx was greatly altered, the mucous membrane covering the epiglottis and the arytenoid cartilages being swollen and ulcerated; the lining membrane of the bronchi was bright-red. The traumatic affection of the leg showed no sign of erysipelas, the healing process appearing to have proceeded satisfactorily."

## SECTION II.—THE LARYNX.

### ANATOMY OF THE LARYNX.

This complicated organ, which serves the double purpose of transmitting air and producing the voice, is situated between the hyoid bone above and the trachea below, having behind it the pharynx, and on each side of it the great vessels and nerves of the neck. When the head is held upright and the larynx is at rest, the middle of the thyroid cartilage is opposite the body of the fifth cervical vertebra, the whole organ from the tip of the epiglottis to the lower border of the cricoid cartilage corresponding to the third, fourth, fifth, and sixth cervical vertebræ. But the position of the larynx is very far from constant, as it ascends and descends to a variable degree during respiration, phonation, and deglutition.

Viewed from the front, the general external configuration of the larynx is as follows:—Passing from above downwards there may be recognized by palpation, or indeed by mere inspection in thin persons: a protuberance (Pomum Adami) less prominent in females and boys before puberty, formed by the meeting in the middle line of the two alæ of the thyroid cartilage; above the laminæ is a deep notch, while below them is the depression for the crico-thyroid membrane, and again lower down the convexity of the cricoid cartilage. Laterally the quadrilateral laminæ of the thyroid cartilage partially covered by the depressors of the hyoid bone may be made out, while below the lower border of the cricoid can be seen or felt a depression corresponding with the junction of that cartilage with the trachea. Still lower there may be noticed, in the middle line, a slight protuberance, the isthmus of the thyroid body, and on either side the lobes of this body, which vary considerably in their development, and in women, generally, give a more rounded form to the neck than in men. Below this crossing of the isthmus the trachea recedes between the converging sterno-cleido-mastoids, and finally disappears behind the suprasternal notch.

The posterior surface of the larynx constitutes the anterior wall of the pharynx.

The upper surface presents in front the ligament, which unites the upper border of the thyroid cartilage with the hyoid bone, and the epiglottis with its five folds of mucous membrane; further back, the superior aperture of the larynx, cordiform in shape, descending in an inclined plane with the larger extremity in front, and limited anteriorly by the epiglottis, laterally by the ary-epiglottic folds, and behind by the apices of the arytenoid cartilages and the upper border of the arytenoid muscle covered with mucous membrane.

The inferior surface of the larynx, corresponding with the lower edge of the cricoid cartilage, presents the ligament which unites that

cartilage with the first ring of the trachea, and the annular opening into the windpipe.

The consideration of the internal surface of the larynx is best deferred till the cartilaginous skeleton and other component parts have been described.

The framework of the larynx is composed of a series of cartilages, nine in number, three being single and three in pairs. The former are known as the thyroid and cricoid cartilages, and the epiglottis. The latter are the arytenoids, and the cartilages of Wrisberg and Santorini. There are also the sesamoid cartilages. The chief portions of the laryngeal framework are so articulated with one another by ligaments as to be capable of a considerable number of movements, which are produced by means of muscles, the function of which is to place the vocal cords in the proper position for phonation. The internal surface of the cartilages, ligaments, joints, muscles, and vocal cords is covered by mucous membrane, and the entire apparatus is supplied with blood-vessels, lymphatics, and nerves.

The thyroid cartilage is the largest portion of the laryngeal framework, and may be described as consisting of two symmetrical four-sided plates, united together in the middle line by an intermediate lamina. They include between them an angle of about 90°, and are somewhat obliquely inclined, so that their external surfaces look slightly downwards. The inferior border of each plate is nearly horizontal, the posterior vertical, while the upper border is sinuous, being concave behind, and boldly convex in front. In the united plates this convexity leads to the formation of a deep notch, which serves for the attachment of the thyro-hyoid membrane. The posterior angles of each plate present two hook-shaped processes, named respectively the greater and lesser cornua. The former projects upwards and somewhat inwards from the superior angle, and is connected by means of ligaments with the greater cornu of the hyoid bone. The latter projects downwards and somewhat forwards from the inferior angle, and presents on the inner surface of its extremity a facet for articulation with the cricoid cartilage.

Placed immediately below the thyroid, and connected with it by means of the articulation just mentioned, is the cricoid cartilage. Its general form is that of a signet ring, the portion representing the seal being placed posteriorly, while the thin and narrow portion corresponding to the ring, but which in this case takes up only a fourth of the whole circumference, is placed in front. Its inner surface is continuous with that of the trachea, being convex from above downwards. Its external surface is plane, and presents in front a prominence between the attachments of the crico-thyroid muscles, posteriorly in the middle line a low vertical ridge, broader below than above, separating shallow depressions for the posterior crico-arytenoid muscles, and on each side an articular facet for the lesser cornu of the thyroid cartilage. This facet, which is circular in form and concave, looks upwards, and is seated upon a wart-like prominence placed halfway between the upper and lower margins of the cartilage, and slightly anterior to the facet for the arytenoid. The upper border of the cartilage is horizontal posteriorly, but slopes rapidly downwards and forwards on each side, and ends in front in a broad but deep notch, to which is attached the crico-thyroid membrane. Just beyond its horizontal portion the upper border presents on each side a sloping oval facet for articulation with the corresponding arytenoid. The lower border is horizontal, and is

connected with the first ring of the trachea, slightly overlapping it anteriorly.

The arytenoid cartilages are situated at the posterior part of the larynx and articulate with the cricoid, upon which they are very freely movable. They are pyramidal in shape with their apices flattened and curved towards the middle line, and their bases obliquely sloped off so as to have an inward aspect. They have attached to them both the vocal cords and ventricular bands. Each cartilage presents for examination a posterior, an anterior or lateral surface, an internal or median surface, and a base. The base, by means of which the cartilage articulates with the facet on the upper border of the cricoid, is concave from before backwards, and presents two well-marked processes. One, the processus vocalis, is a prolongation of the angle formed at the junction of the base with the lateral and median surfaces; it projects forwards into the larynx, and gives attachment to the true vocal cord. The other, the processus muscularis, is connected with the external angle of the base, and gives attachment to the posterior and lateral crico-arytenoid muscles.

The smaller cartilages may be briefly dismissed. The cartilages or cornicula of Santorini are two small masses of fibro-cartilage, about as large as millet-seeds, and situated at the apex of the arytenoids. The cartilages of Wrisberg are two soft fibro-cartilaginous plates embedded in a group of mucous glands occupying the ary-epiglottic folds, and are occasionally wanting. The sesamoid cartilages are very far from constant, but when present they occur in the form of two small elongated masses, attached by means of elastic fibres along the lateral border of each arytenoid.

The epiglottis is a fibro-cartilage, which varies somewhat in shape. When seen from behind it has a leaf-like form, with its stalk below and expansion above. Removed from the pharynx and placed with its anterior surface uppermost and stalk foremost, it has very much the shape of an elongated saddle. As seen with the laryngoscope it varies very much in appearance, according to its inclination in relation to the thyroid cartilage, and according to the extent its expanded portion curls round on itself. In adults it is, in most cases, almost vertical, but in children it is often obliquely horizontal—lower behind than in front. It is attached by its lower margin to the inner surface of the thyroid cartilage by means of a firm band of elastic tissue, and at this point forms a projection, which in life (seen from above) has a rounded form, and is called the cushion of the epiglottis. Its free upper margin rises above the base of the tongue, with which it is loosely connected by means of three reduplications of mucous membrane—the glosso-epiglottic folds. The anterior surface is concave vertically, and convex from side to side, while the posterior surface is curved in exactly reverse directions, and is pierced by numerous little pits, which contain the glandulæ opening on the surface of the mucous membrane. The margin of the epiglottis is sharp, and there is often a notch in the centre of its upper free edge. It gives attachment to the ary-epiglottic and pharyngo-epiglottic folds of mucous membrane.

The structure of the cartilages (with the exception of the epiglottis and cornicula) is hyaline; in the arrangement of the cells it differs from articular cartilage, but corresponds to the cartilages of the ribs, and like them is prone to ossify. The epiglottis and cornicula are fibro-cartilages, and in man do not become ossified.

The ligaments of the larynx are: (1) the extrinsic, which unite the larynx with other parts; (2) the intrinsic, which unite the different parts of the larynx together; and (3) the mixed, which serve both these uses. The extrinsic are the thyro-hyoid and the crico-tracheal. The thyro-hyoid ligaments are three in number, viz., the thyro-hyoid membrane in the middle line and the thyro-hyoid ligaments proper on either side. The thyro-hyoid membrane is a rather delicate band of elastic tissue, attached above to the posterior border of the body of the hyoid bone, and below to the margins of the superior thyroid notch. It has in front a bursa, and it is separated from the epiglottis behind by a considerable cushion of fat. The thyro-hyoid ligaments are cylindrical bands of fibro-elastic tissue uniting the greater cornua of the thyroid cartilage with the extremities of the hyoid bone. Between these ligaments and the thyro-hyoid membrane the hyoid bone is connected with the thyroid cartilage by means of a thin layer of fibrous tissue. The crico-tracheal ligament is a fine membranous expansion, which extends from the lower border of the cricoid cartilage to the first ring of the trachea.

The intrinsic ligaments are the crico-thyroid, the crico-arytenoid, the superior thyro-arytenoid, and the inferior thyro-arytenoid (vocal cords), whose ligamentous use, however, is entirely subservient to their higher function. The crico-thyroid ligament is a band of elastic membrane attached in front to the upper border of the cricoid and the lower border of the thyroid. The crico-arytenoid ligaments consist for the most part of scattered fibres, which assist in forming the capsule of the joint; on the posterior surface of the cricoid cartilage, however, near its upper border and outer corner, the ligamentous fibres are consolidated into a strong band, which is inserted into the posterior and inner surface of the arytenoid cartilage near its base. The superior thyro-arytenoid ligaments consist of only a few scattered fibres, which are not continuous, and though, to a great extent, constituting the ventricular bands, scarcely deserve the name of ligaments; they are inserted anteriorly in the receding angle of the thyroid cartilage just above the insertion of the epiglottis. The inferior thyro-arytenoid ligaments are the most important structures in the larynx—the most essential features of the organ. They are formed of strong bands of yellow elastic tissue extending from the receding angle of the thyroid cartilage anteriorly, to the projecting angles at the base of the arytenoid cartilages (processûs vocales). Examining them more in detail we find that each vocal cord is made up of fibres which are collected into a single band only at their anterior extremity; posteriorly they separate at an acute angle into three divisions; the first of these passes slightly upwards, and is inserted just behind the posterior extremity of the ventricle; the second is attached to the processus vocalis of the arytenoid cartilage and to the surface of the cartilage above the process, and the third, dividing into five or six small bundles, is attached to the lower part of the inner surface of the arytenoid cartilage, some of its fibres extending beneath the capsule of the crico-arytenoid articulation and reaching the upper border of the cricoid cartilage. The vocal cords are covered with the mucous membrane of the larynx, and the fibres of the thyro-arytenoid muscle assist in forming a large proportion of their substance. When a vocal cord is drawn towards the median line, and a vertical section is made through it parallel with the anterior surface of the spinal column,

it is seen to be triangular or prismatic. Two sides of the triangle are free, one directed upwards towards the ventricular band, the other downwards and inwards towards the lower part of the opposite side of the trachea, and the third is the outer and attached edge. Sound is produced by the vibrations of the vocal cords when approximated.

The only mixed ligament is the epiglottic. It consists of an extrinsic and intrinsic portion. The former is composed of a central glosso-epiglottic ligament uniting the anterior surface of the epiglottis to the root of the tongue, and two hyo-epiglottic ligaments passing outwards from the middle of the anterior surface of the epiglottis to the extremities of the body of the hyoid bone. The intrinsic portion or thyro-epiglottic ligament, is a firm but narrow fibrous band connecting the lower end of the epiglottis with the thyroid cartilage just below its notch.

Between the cartilages and the mucous membrane of the larynx is a continuous layer of elastic fibrous tissue, which assists in supporting the general structure of the larynx, and effectually adds to its resiliency. It is attached below to the cricoid cartilage, becomes blended with the crico-thyroid ligaments, and enters into the formation of the vocal cords; it lines the ventricles of the larynx, and, thickening again, forms the ventricular bands. It can be traced into the ary-epiglottic folds, and after becoming firmly attached to the thyroid cartilage, forms the ary-epiglottic ligaments; anteriorly it becomes blended with the thyro-epiglottic and glosso-epiglottic ligaments. In those portions of the laryngeal tube where there are no ligaments connecting the moveable cartilages with one another, this fibro-elastic lamina is very thin, and can be with difficulty separated from the mucous membrane.

The articulations of the larynx consist of the crico-thyroid and crico-arytenoid articulations, and the fibrous connections between the arytenoids and the cartilages of Santorini. The crico-thyroid articulation is composed of two true joints placed laterally, by means of which the lesser cornua of the thyroid cartilage articulate with the circular facets on the cricoid. These joints are provided with articular cartilages, synovial membranes, and capsular ligaments, and the movements they admit of are those of flexion and extension. The crico-arytenoid articulations consist of the two joints between the bases of the arytenoids and the facets on the upper border of the cricoid. Each joint is saddle-shaped, and is provided with a synovial membrane and a lax fibrous capsule, admitting of a very extensive series of movements. The articulation between each arytenoid and the corresponding cartilage of Santorini consists of a thin layer of fibro-elastic cartilage, which admits of very free movement in every direction.

The muscles of the larynx may be divided for purposes of description into three sets:—First, a well-defined group on the anterior surface, connecting the cricoid cartilage with the lower border of the thyroid, and termed the crico-thyroidei; secondly, a pair of triangular muscles on the posterior surface of the cricoid cartilage, known as the crico-arytenoidei postici or abductors of the vocal cords; and, lastly, a group of smaller muscles in the upper part of the larynx, arranged in a somewhat sphincter-like manner, and including the thyro-ary-epiglottici, the arytenoideus, the thyro-arytenoidei externi and interni, and the crico-arytenoidei laterales or adductors.

All the laryngeal muscles, with the exception of the arytenoideus, occur in pairs.

The crico-thyroideus muscle of each side may be easily shown, on dissection, to consist of two layers of fairly well-defined muscle triangular in shape. In the superficial layer, the fibres pass in a more or less vertical direction, and this portion has been termed on this account the crico-thyroideus rectus. In the deeper layer, the oblique arrangement of the fibres has caused the muscle to be known as the crico-thyroideus obliquus. The former is attached below to the anterior surface of the cricoid cartilage close to the middle line, and spreading out as it ascends is inserted into the anterior third of the lower margin of the corresponding thyroid plate. The crico-thyroideus obliquus springs from the narrow anterior surface of the cricoid by two heads which embrace the attachment of the crico-thyroideus rectus, and running obliquely upwards and backwards is inserted into the posterior two-thirds of the lower margin of the corresponding thyroid plate, and the whole anterior border of the lesser horn.

The crico-arytenoideus posticus is a flat triangular muscle, which arises from a shallow depression external to the median ridge on the posterior surface of the cricoid; its fibres converge as they pass upwards and outwards, and are inserted into the posterior margin of the base of the corresponding arytenoid cartilage, between the attachments of the arytenoideus and crico-arytenoideus lateralis.

The third group of laryngeal muscles, the arrangement of which, as already remarked, bears some resemblance to a sphincter, may be divided into three layers. The outermost layer consists of the two thyro-ary-epiglottici; the middle layer of the arytenoideus, the thyro-arytenoidei externi, and the crico-arytenoidei laterales; while the innermost layer consists of the two thyro-arytenoidei interni.

The thyro-ary-epiglotticus is a flat, narrow muscle, which, taking origin from the processus muscularis of the arytenoid cartilage, passes upwards and inwards, crosses its fellow in the middle line, and is inserted into the upper half of the lateral border of the arytenoid of the opposite side, and the posterior border of the corresponding cartilage of Santorini. The lower fibres, after their attachment to the arytenoid, run forwards and slightly downwards, to be inserted into the thyroid cartilage near its receding angle, while the fibres which are attached to the Santorinian cartilage are continued forwards and upwards into the ary-epiglottic fold, where they are joined by certain scattered fibres which arise from the thyroid cartilage, close to the anterior attachment of the muscle.

The arytenoideus is a flat quadrilateral muscle attached to the lateral borders of the arytenoid cartilages, and running horizontally between these attachments. It is covered posteriorly by the thyro-ary-epiglottici, while in front it is in direct relation with the laryngeal mucous membrane. The thyro-arytenoideus externus usually consists of three portions, a lower, middle, and upper, the two latter being, however, occasionally absent. The lower portion may again be divided into two layers, an external and an internal. These arise side by side from the lower half of the internal surface of the thyroid cartilage, close to its receding angle, and from the fibrous expansion of the crico-thyroid ligament, and pass backwards to be inserted into the lateral border of the arytenoid cartilage. The inner portion runs in a horizontal direction, and is attached to the lower half of this border, while the outer por-

tion passes obliquely upwards, to be attached to the upper half, some of its fibres passing to the cartilage of Wrisberg and the ary-epiglottic fold. The middle portion of the thyro-arytenoideus externus takes origin from the angle of the thyroid cartilage close to its upper notch, and running obliquely downwards is inserted into the processus muscularis of the arytenoid cartilage. The upper portion of the muscle is also attached to this process, but its upper attachment is to the lateral border of the epiglottis, and it serves the same function, and sometimes takes the place of the ascending fibres of the thyro-ary-epiglotticus. The crico-arytenoideus lateralis arises from about the middle third of the upper border of the cricoid cartilage, and is inserted into the whole anterior margin of the base of the arytenoid, a few fibres occasionally passing on to join the thyro-ary-epiglotticus.

The thyro-arytenoideus internus is a prism-shaped muscle, which arises from the angle of the thyroid cartilage just internal to the origin of the thyro-arytenoideus externus, and running parallel to, and in the substance of the vocal cord, is inserted into the apex and upper and lower surfaces of the processus vocalis. On transverse section it is seen to have three borders, the inner of which projects into the vocal cord, while the two outer and the side of the muscle between them lie upon the inner surface of the thyro-arytenoideus externus of the same side.

Lastly, there remains to be mentioned a muscle which is only exceptionally present, and which has been variously termed the crico-thyroideus posticus, and the kerato-cricoideus. It consists of a narrow band of fibres which arises from the posterior surface of the cricoid cartilage just below the origin of the crico-arytenoideus posticus, and passing upwards and outwards is inserted into the posterior margin of the lesser cornu of the thyroid cartilage.

The laryngeal muscles have two different functions to perform. They have, first, to control the entrance into the larynx, opening it and closing it as circumstances may require; and, secondly, to provide for the proper tension of the vocal cords during phonation. These functions, however, are not entirely independent of each other. The muscles which narrow or close the entrance to the larynx include, in the first place, all those fibres which ascend to be attached to the epiglottis, as well as those which encircle the vestibule; secondly, the laryngeal inlet is constricted by the arytenoideus, which approximates the arytenoid cartilages to each other; thirdly, the true glottis is closed by the action of the thyro-arytenoidei interni and the crico-arytenoidei laterales, both of which muscles are able to rotate the arytenoid cartilages on their bases, and to approximate their vocal processes. The contrary action, viz., the widening of the glottis, is effected by the crico-arytenoidei postici, which rotate the arytenoid cartilages outwards, and so separate the posterior attachments of the vocal cords. The muscles which preside over the tension of the vocal cords are the crico-arytenoidei postici, the crico-thyroidei obliqui and recti, and the thyro-arytenoidei interni. The first-named muscles fix the arytenoid cartilages upon the cricoid: the crico-thyroidei draw the angle of the thyroid cartilage forwards and downwards in relation to the cricoid; while the thyro-arytenoidei interni, by their contraction and expansion, produce in the vocal cords the degrees of tension necessary for the production of notes of different pitch.

The arteries of the larynx are the superior laryngeal, the middle

laryngeal or crico-thyroid, and the inferior or posterior laryngeal. The superior laryngeal is in most cases derived from the superior thyroid, though it occasionally springs immediately from the external carotid. Running almost directly inwards between the greater horn of the hyoid bone and the upper border of the thyroid cartilage, it passes beneath the thyro-hyoid muscle and enters the larynx by perforating the thyro-hyoid membrane. Having sent an epiglottic branch upwards, it passes obliquely downwards towards the middle of the lower border of the thyroid plate, supplying in its course the muscles and the mucous membrane in the upper part of the larynx. Just before reaching the lower border of the thyroid cartilage it divides into two terminal branches, the larger of which anastomoses with the crico-thyroid, and the smaller with the inferior laryngeal artery. The middle laryngeal or crico-thyroid artery arises from the superior thyroid nearly opposite the upper margin of the thyroid cartilage, and passes downwards and forwards, lying upon the thyro-pharyngeus and thyro-hyoid muscles. Arrived at the lower border of the thyroid cartilage it divides into two branches, the outer of which passes into the larynx below the inferior margin of that cartilage, and joins a branch of the superior laryngeal, while the inner division, uniting with its fellow on the opposite side, perforates the crico-thyroid ligament and is distributed to the laryngeal mucous membrane below the vocal cords. The inferior or posterior laryngeal artery is derived from a branch of the inferior thyroid, and passing upwards, together with the inferior laryngeal nerve, behind the crico-thyroid articulation, divides into two branches, one of which unites with a branch of the superior laryngeal, while the other is distributed to the crico-arytenoideus posticus muscle.

The veins of the larynx for the most part have a similar arrangement to that of the arteries, but their anastomoses with each other and with the veins of the thyroid glands, the root of the tongue and the trachea, are more numerous. They terminate in the internal jugular.

The lymphatics of the larynx are abundantly supplied to the mucous membrane, but the cartilages, muscles, and ligaments are described as being entirely destitute of them. They are arranged in the form of a thick network, which closely follows the arrangement of the mucous membrane, but the vessels are much narrower and the meshes much wider on the posterior surface of the epiglottis and along the true cords than in other parts of the laryngeal surface. The lymphatic capillaries of the larynx unite together to form lymphatic trunks at four different points, two of which are situated above the right and left ventricle respectively, and two below the cricoid cartilage, one on each side. The upper trunks receive the lymphatics from the epiglottis and from the upper and middle compartments of the larynx, and pass outwards between the greater cornua of the hyoid bone and the upper border of the thyroid cartilage to join lymphatic glands. The lower trunks receive the lymphatics from the lower compartment of the larynx and terminate in lymphatic glands, situated on either side of the trachea.

The nervous supply of the larynx is derived from the superior and inferior or recurrent laryngeal nerves. These are branches of the pneumogastric nerve, but there is considerable evidence to show that those fibres which are derived from the spinal accessory nerve go, at least in part, to the laryngeal branches. The former

is for the most part a sensory nerve, but it supplies a motor branch to one group of muscles, the crico-thyroids. The remaining laryngeal muscles are supplied from the inferior laryngeal, which is exclusively a motor nerve.

The superior laryngeal nerve divides into two branches opposite the greater cornu of the hyoid bone. The external or smaller branch descends over the thyro-pharyngeus muscle to the lower border of the thyroid plate, where it enters the crico-thyroid muscle. The internal branch enters the larynx by perforating the thyro-hyoid membrane, and passing inwards and slightly backwards, directly beneath the mucous membrane forming the floor of the sinus pyriformis, divides into numerous branches, which pass upwards, inwards, and downwards. Some of these branches, the pharyngeal, are distributed to the mucous membrane of the pharynx as low down as the lower border of the cricoid cartilage, as well as to the sinus pyriformis and outer layer of the ary-epiglottic fold. Other branches, the laryngeal, supply the whole internal surface of the larynx.

The right recurrent nerve is given off from the pneumogastric just below the level of the commencement of the ascending portion of the right subclavian artery, and, passing behind the carotid artery, ascends between the trachea and œsophagus, where it pierces the inferior constrictor and enters the larynx close behind the crico-thyroid articulation. In the first part of its course it is in proximity to the apex of the right lung. The left recurrent nerve is given off by the left pneumogastric on a level with the lower border of the arch of the aorta, and, winding round the transverse portion of the arch, it ascends to the larynx. After entering the larynx the nerves divide into branches which supply the laryngeal muscles.

The inner surface of the larynx may be divided into three portions, an upper, middle, and inferior, lying immediately one above another, and easily defined by natural limits.

The uppermost of these spaces, or vestibule of the larynx, is of a somewhat tubular form, but, owing to its sloping upper aperture, of greater depth in front than behind. It is bounded by the different cartilages, united together by reduplications of mucous membrane. Its upper boundary is identical with that of the larynx above described, while its lower margin is formed by the ventricular bands. The anterior wall of the vestibule is formed by the epiglottis, and is convex in its upper third, concave in its middle third, corresponding to the insertion of the pharyngo-epiglottic folds, while its lower third is a boldly projecting, round protuberance, the epiglottic cushion, the inferior border of which, becoming gradually smaller, changes into a sort of triangular gutter between the anterior extremities of the ventricular bands. The lateral walls of the vestibule, which form a furrow with the anterior, decrease in depth from before backwards, and are formed by the ary-epiglottic ligaments, and their reduplications of mucous membrane. The posterior wall is formed by the cartilages of Santorini, and those segments of the arytenoid cartilages to which are attached the superior vocal cords.

The middle compartment of the larynx is bounded above by an imaginary plane uniting the ventricular bands, below by the true cords, while its lateral boundaries are the two ventricles or pouches of Morgagni contained between these structures. The aperture

between the ventricular bands is more or less oval in shape, but wider behind than in front; it slopes obliquely downwards and backwards, and terminates in the fissure separating the arytenoids. The inferior boundary of the cavity is constituted by the true vocal cords, the space between them being known as the rima glottidis. This space is in the adult about four-fifths of an inch in length, and, when the vocal cords are separated to their utmost, about half an inch across at its widest part. The glottis is larger in life than the cadaveric position of the vocal cords would indicate, the abductors being more powerful than the adductors. During quick inspiration and expiration, a condition corresponding with its greatest distension, its form is that of an isosceles triangle with its base posterior and its angles rounded off, but on forcible expiration, the edges of the rima approximate, and the vocal cords become parallel. The ventricle of Morgagni is oblong in shape, extending for about the length of the cords, and having externally the thyro-arytenoid muscle, and its mucous covering. Its external wall presents two crescentic folds of mucous membrane, between which is a deep fossa, and posteriorly a smaller funnel-shaped depression; while passing upwards to the vestibule, between the cartilages of Santorini and Wrisberg, is a shallow channel, the filtrum.

The inferior laryngeal space is bounded by the cricoid cartilage, the lower half of the angle of the thyroid cartilage, the vocal processes of the arytenoid cartilages, and the elastic and mucous structures, which extend downwards from the free borders of the vocal cords; laterally the walls of this space diverge below the cords to the calibre of the commencement of the trachea.

The internal surface of the larynx is covered throughout by a mucous membrane, continuous above with that of the tongue and pharynx and below with that of the trachea. In passing from the root of the tongue in front to the anterior surface of the epiglottis, it presents three well-marked reduplications—the glosso-epiglottic folds—one central and two lateral, including between them two shallow fossæ. Laterally it descends from the pharynx over the palato-pharyngeus muscle, to be attached to the upper portion of the inner surface of the thyroid cartilage, whence it passes again upwards, external to the thyro-ary-epiglotticus, to form the outer layer of the ary-epiglottic fold. The fossa thus formed is termed the sinus pyriformis. In front of the vestibule the mucous membrane is firmly attached to the posterior surface of the epiglottis, and below that cartilage to the receding angle of the thyroid, forming a well-marked furrow between the anterior attachments of the ventricular bands. The mucous membrane covering the lateral wall of the vestibule is smooth in front, but as it approaches the middle line behind, it dips slightly down between the Wrisbergian and arytenoid cartilages to form the filtrum, a shallow furrow, which passes downwards and forwards, and ends in the ventricle of Morgagni. Still further back the mucous membrane is firmly attached to the median surface of the arytenoid cartilage. Passing downwards, the mucous lining of the vestibule is continued over the ventricular band, to which it is somewhat loosely attached, into the ventricle of the larynx. It covers the whole internal surface of this cavity, presenting the folds and fossæ which have been described above, and passing again inwards attaches itself firmly to the sharp edge of the true cord. Between the cords posteriorly, it loosely covers the anterior surface of the arytenoideus

muscle, being thrown into vertical folds on the contraction of this muscle, and the resulting approximation of the arytenoids. Below the vocal cords the mucous membrane is attached rather closely to the inner surface of the cricoid cartilage, whence it is continued downwards to form the tracheal lining.

The laryngeal mucous membrane presents both tesselated and ciliated epithelium. The latter has the more general distribution, the tesselated cells being confined to the upper and under surfaces of the epiglottis, to a narrow zone just within the upper aperture of the larynx, and to the projecting edges of the true cords, which are covered by a band of large, flattened, angular cells. In these parts the epithelial layer is in direct contact with the mucosa, but, elsewhere, it rests upon a transparent homogeneous basement or limitary membrane, a structure which plays an important part in the pathology of laryngeal diphtheria. It occasionally presents itself as an entirely independent layer, which can be separated without difficulty from the subjacent structures, but as a rule it is intimately connected with the fibrous tissue of the mucosa. According to Luschka, however, a homogeneous basement membrane only exists in the vicinity of the true cords, and even here it contains both fibrillæ and colonies of cellular elements. The mucosa itself consists of a connective tissue of delicate fibrils enclosing numerous proliferating masses of cells. These cells, which are finely granular, and consist of a distinct nucleus enclosed in a thin layer of protoplasm, vary considerably in size and number, being least numerous in the mucous covering of the true cords. Luschka regards them as the real matrix of the laryngeal epithelium, and assigns them an important share in all inflammatory affections of the larynx. The presence of these proliferating cell-masses is the chief distinguishing mark between the mucosa and the next layer of the mucous membrane, the submucosa. The latter consists of numerous wavy elastic fibrillæ, which run more or less parallel to the surface and are, as a rule, longer and somewhat coarser than the fibres of the mucosa. They enclose here and there spindle-shaped cells, which consist of an elongated, finely-granular nucleus, and a thin layer of protoplasm, prolonged at one end into a wavy, tail-like process. The laryngeal mucous membrane presents very few papillæ, and these only in certain limited regions, viz., upon the anterior surface of the epiglottis, and along the edge of the true cords. Throughout the larynx the mucous membrane is richly provided with glands, which occur both solitarily and in groups. They are plentifully scattered over the prominence at the base of the epiglottis, along the furrows on each side of that cartilage, in the neighbourhood of the cartilages of Wrisberg, on the ventricular bands, and throughout the walls of the ventricles, with the exception of the upper surfaces of the vocal cords. They are also irregularly distributed over the posterior wall of the larynx, especially in the neighbourhood of the crico-arytenoid articulations.

For further details the anatomical student is referred to the following works which have been largely laid under obligation by the author:—Luschka: "Der Kehlkopf des Menschen," Tübingen, 1871; Henle: "Handbuch der systematischen Anatomie des Menschen," Zweite Auflage, Braunschweig, 1873; and "Manual of Human and Comparative Histology," by Professor Stricker. Translated by Henry Power, M.B. New Sydenham Society's Trans. London, 1872.

# THE LARYNGOSCOPE

## AND ITS ACCESSORY APPARATUS.

*History of its Invention.*—There is no trace of a laryngoscope before the middle of the eighteenth century, but in the year 1743 M. Levret, a distinguished French accoucheur, whose highly inventive genius had led him to contrive surgical instruments of almost every description, occupied himself in discovering means, whereby polypoid growths in the nostrils, throat, ears, and other parts, could be tied by ligatures.[1] It is unnecessary to describe here the various ingenious instruments which he invented for the purpose, but it may be observed that in using them he employed a speculum which differed from the various *specula oris* then in use. It consisted mainly of a plate of polished metal (*plaque polie*), which "reflected the luminous rays in the direction of the tumour," and at the same time received the image of the tumour on its reflecting surface.

About the year 1804, a certain Dr. Bozzini, of Frankfort-on-the-Maine, caused a great sensation throughout Germany, with his invention for illuminating the various canals of the body. He had made known his ideas a few years previously, but it was not till 1807[2]

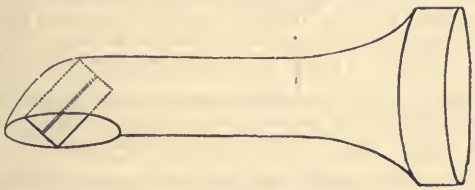

FIG. 11.—BOZZINI'S LARYNGEAL SPECULUM (*after Hufeland*).

**In the drawing from which this is taken, the mirrors are directed upwards, as they would be when employed in rhinoscopy.**

that he published a work on the subject. Bozzini's invention consisted of two essential parts: First, a kind of lantern; and, secondly, a number of hollow metal tubes (*specula*) for introducing into the various canals of the body. The lantern was a vase-shaped apparatus made of tin, in the centre of which was a small wax candle. In the side of the lantern there were two round holes, a larger and a smaller one, opposite each other. To the smaller one an eye-piece was fixed, to the larger the speculum was fitted. The flame of the candle was situated just below the level of these two apertures. The mouth of the speculum—a tube of polished tin or silver—was always of the same size; but the diameter of the tube beyond its orifice varied according to the canal into which it had to be introduced. The apparatus was about thirteen inches high, two inches from before

[1] "Mercure de France." 1743, p. 2,434.

[2] "Der Lichtleiter, oder Beschreibung einer einfachen Vorrichtung, und ihrer Anwendung zur Erleuchtung innerer Höhlen und Zwischenräume des lebenden animalischen Körpers." Von Philipp Bozzini, der Medizin und Chirurgie Doctor. Weimar, 1807.

backwards, and rather more than three from side to side. In employing reflected light, Bozzini had the speculum divided by a vertical partition, so that there were, in fact, two canals and two mirrors. One of these mirrors was intended to convey the light, the other to receive the image.

In the year 1825,[1] M. Cagniard de Latour, the successor of Savart at the French Academy of Sciences, and, like him, an earnest investigator of the physiology of the voice, made an unsuccessful endeavour to examine the larynx during life.

In the year 1827,[2] Dr. Senn, of Geneva, "had a little mirror constructed for introduction to the back of the pharynx; with it he tried to see the upper part of the larynx—the glottis; but he gave up its use on account of the small size of the instrument."

In the year 1829,[3] Dr. Benjamin Guy Babington exhibited at the Hunterian Society of London an instrument closely resembling the laryngoscope now in use. Two mirrors were employed, one smaller, for receiving the laryngeal image, the other larger, for concentrating the solar rays on the first. The patient sat with his back to the sun, and, whilst the illuminating mirror[4] (a common hand looking-glass) was held with the left hand, the laryngeal mirror—a glass one coated with quicksilver—was introduced with the right.

In the year 1832,[5] Dr. Bennati, of Paris, used an instrument made by one of his patients named Selligue. It consisted of a double-tubed speculum, one tube of which served to carry the light to the glottis, and the other to bring back to the eye the image of the glottis reflected in the mirror, placed at the guttural extremity of the instrument.

In the year 1838,[6] M. Baumês exhibited at the Medical Society of Lyons a mirror about the size of a two-franc piece, which he described as being very useful for examining the posterior nares and larynx.

In the year 1840,[7] Liston, in treating of œdematous tumours which obstruct the larynx, observed as follows: "The existence of this swelling may often be ascertained by a careful examination with the fingers, and a view of the parts may sometimes be obtained by means of a speculum—such a glass as is used by dentists on a long stalk, previously dipped in hot water, introduced with its reflecting surface downwards, and carried well into the fauces."

In the year 1844,[8] Dr. Warden, of Edinburgh, conceived the idea of employing a prism of flint glass for obtaining a view of the larynx.

In the year 1844,[9] Mr. Avery, of London, invented a laryngoscope in principle very similar to that now in use. The reflector was attached

[1] "Physiologie de la Voix," par Edouard Fournié, Paris, 1865, p. 352.

[2] "Journal des progrès des sciences, etc." 1829, p. 231, note.

[3] "Lond. Med. Gaz." London, 1829, vol. iii. p. 555.

[4] Illustrations of this instrument will be found in my work on "The Laryngoscope," 3rd edition, page 14.

[5] "Recherches sur le Mécanisme de la Voix Humaine." Page 37, note.

[6] "Compte Rendu des Travaux de la Société de Médecine de Lyons." 1836-38, p. 62.

[7] "Practical Surgery." 1840, 3rd edition, p. 417.

[8] Royal Scottish Society of Arts. Description, with illustrations, of a Totally Reflecting Prism for Illuminating the Open Cavities of the Body, etc. etc. May, 1844; see also "Lond. Med. Gaz." vol. xxiv. p. 256.

[9] "Med. Circ." June, 1862, vol. xx.; and "Introduction to the Art of Laryngoscopy," by Dr. Yearsley. London, 1862. The instrument is figured on page 24 of my work on "The Laryngoscope."

to a frontal-pad, and was retained in its place by two springs which passed over the operator's head to the occipital protuberance, where there was a counter-pad. There were two defects, however, in Avery's apparatus: the one was, that the laryngeal mirror (instead of being fixed to a slender shank) was placed at the end of a speculum; the other, that instead of employing the reflector for receiving the rays from a lamp placed on the table or elsewhere, Avery used his large circular mirror for the purpose of increasing the luminous power of a candle held near the patient's mouth.

In the laryngoscope of Bozzini and Avery the lamp and the reflector are combined, whilst in the modern instrument they are separate. The laryngeal mirror of Bozzini and Avery was placed at the end of a speculum: Czermak's was a modification of the dentist's mirror. Mr. Avery's invention was not placed on record till some time after the modern laryngoscope had come into use.

In the year 1854,[1] "the idea of employing mirrors for studying the interior of the larynx during singing" occurred to Signor Manuel Garcia. He had often thought of it before, but, believing it impracticable, had never attempted to realize the idea. The efforts of Signor Garcia, who was quite unaware that any similar attempts had previously been made in the same direction, were crowned with success, and the following year he presented a paper to the Royal Society of London, entitled "Physiological Observations on the Human Voice."[2] This paper contained an admirable account of the action of the vocal cords during inspiration and vocalization; some very important remarks on the production of sound in the larynx; and some valuable reflections on the formation of chest and falsetto notes. Signor Garcia's laryngoscopic investigations were all made on himself; indeed, he was the first person who conceived the idea of an autoscopic examination. His method consisted in introducing a little mirror, fixed to a long stem, suitably bent, to the top of the pharynx. He directed that the person experimented upon should turn towards the sun, so that the luminous rays falling on the little mirror should be reflected into the larynx;[3] but he added in a foot-note, that "if the observer experiments on himself, he ought, by means of a second mirror, to receive the rays of the sun, and direct them on the mirror which is placed against the uvula." Signor Garcia's communication to the Royal Society, though causing little stir at the time, was destined to create a new era in the physiology and pathology of the larynx. Treated with apathy, if not with incredulity, in England, his paper passed into the hands of Dr. Türck, of Vienna, and soon effected a revolution in the investigation and treatment of laryngeal disease.

In the year 1857,[4] during the summer months, Professor Türck,

[1] "Notice sur l'Invention du Laryngoscope," par Paulin Richard. Paris, 1861; see M. Garcia's letter to Dr. Larrey, dated May 4, 1860 (page 12 in Richard's pamphlet).

[2] "Proc. Royal Society of London," vol. vii. No. 13, 1855; "Philosoph. Magazine and Journal of Science," vol. x. p. 218; and "Gaz. Hebdom. de Méd. et Chir." Nov. 16, 1855, No. 46.

[3] It is worthy of note that Garcia never really followed this plan, but, in point of fact, always used a second mirror for throwing the solar rays on to the laryngeal mirror. In the mirror which he used as a reflector, he also saw the autoscopic image.

[4] "Zeitschrift der Ges. der Aerzte zu Wien." April 26, 1858.

of Vienna, endeavoured to employ the laryngeal mirror in the wards of the General Hospital.

In the month of November of the same year,[1] Professor Czermak, of Pesth, commenced to work with one of Dr. Türck's laryngeal mirrors, and in a short time he overcame all difficulties. Artificial light was substituted for the uncertain rays of the sun, the large ophthalmoscopic mirror of Ruete was used for concentrating the luminous rays, and mirrors were made of different sizes. Thus it was that Garcia's re-invention of the laryngeal mirror led Czermak to create the art of laryngoscopy.

The references, in nearly every section of this work, to medical practitioners in Europe and America, will afford evidence as to the great development of this new department of practical medicine in recent times.

The Laryngoscope is essentially the laryngeal mirror, but for practical purposes it may be said to consist of two parts :

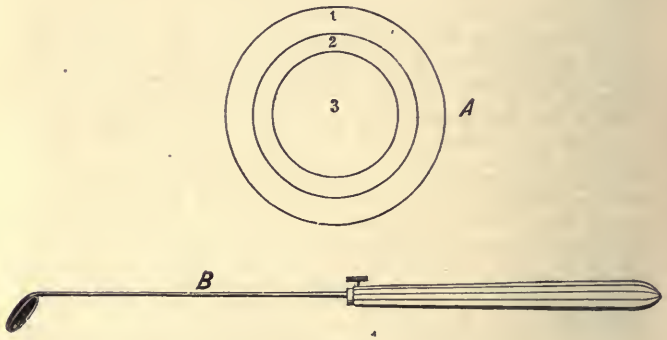


FIG. 12.—THE LARYNGEAL MIRROR.

*A.* Diagram showing the exact sizes of the reflecting surface of the mirrors Nos. 1, 2, and 3. *B.* The mirror and holder (half-size) seen in profile.

1st, a small mirror fixed to a long slender shank, which is introduced to the back of the throat; and 2ndly, an apparatus or arrangement for throwing a strong light (solar or artificial) on to the small mirror.

*The Laryngeal Mirror.*—This may be made of polished

[1] "Wien. Medizin. Wochenschrift." March, 1858; and "Physiolog. Unters. mit Garcia's Kehlkopfspiegel," mit iii. Tafeln. Sitzber. der. k.k. Akademie Wiss. in Wien, vom. 29 April, bd. xxix. p. 557. (Afterwards reprinted in a separate form.)

steel, or of glass backed with amalgam. Though, on theoretical grounds, the steel mirrors give the more perfect image, they so readily become tarnished and rusty from the least moisture, are so immediately spoilt by accidental contact with the medicated solutions used in treating laryngeal disease, and so soon become scratched in cleaning, that they are not found convenient in practice. The glass mirror is generally mounted in German silver; for though the metal is too favourable to the rapid cooling of the mirror, and the consequent deposit of moisture upon it, it is more easy to fix the shank of the instrument to a frame of metal than to any other substance of inferior conducting power. The mirrors should not be more than one-twentieth of an inch in thickness.

The reflecting surface of the laryngeal mirror may vary from half an inch to an inch and a quarter in diameter. It is well to be provided with at least three mirrors, varying in size between the dimensions specified. The largest sized mirror is called No. 1, the middle sized one No. 2, and the smallest No. 3.

For ordinary purposes, a No. 2 mirror will be found most convenient. It may be of square, circular, or oval shape. The circular mirrors cause least irritation, except when enlarged tonsils are present, in which case the oval mirrors are most suitable. The shank of the mirror should be of German silver; it ought to be about four inches in length, and one-tenth of an inch in thickness, and should be soldered to the back of the mirror, so that the latter forms with it an angle of about 120 deg. The handle should be about three inches in length, and rather more than a quarter of an inch in thickness. The shank or stem of the mirror is sometimes, for the sake of portability, made to slide into a hollow wooden handle, and is fixed there by a screw, as is shown in the annexed drawing (Fig. 12, B). The little screw referred to is, however, apt to get loose, and if the stem is made moveable, it should be screwed into the handle—the end of the stem itself forming the screw. It is better, perhaps, to have the stem immoveably fixed to the handle, as firmness is thereby ensured.

*Arrangements for Reflecting the Light.*—For throwing a light on to the laryngeal mirror, and thus into the larynx, it will be found most convenient to employ a circular mirror about three inches and a half in diameter, with a small

hole in the centre.[1] When artificial light or diffused day light is employed, the mirror should be slightly concave, and have a focal distance of about fourteen inches; but when solar light is made use of, the surface of the mirror should be plane. The mirror may be attached in some way to the operator's head, or fixed to a horizontal arm, which is connected with the body of the lamp (Tobold).[2] The former plan is by far the most convenient, and the mirror may be worn either opposite one of the eyes (Czermak),[3] in front of the nose and mouth (Bruns),[4] or on the forehead (Fournié,[5] Johnson,[6] &c.). Of these positions, the first is, on theoretical grounds, the most perfect; the last the easiest in practice. The plan of looking through the hole of the reflector offers the great advantage of

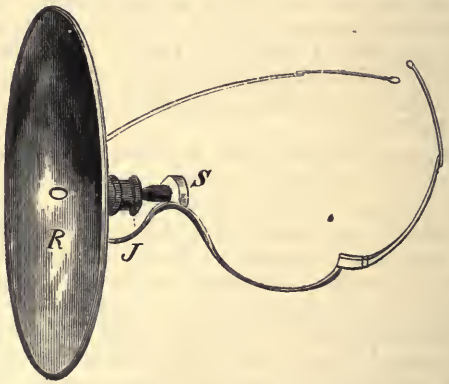


FIG. 13.—REFLECTOR ATTACHED TO SPECTACLE-FRAME, FROM WHICH THE UPPER HALVES OF THE RIMS HAVE BEEN REMOVED.

At the back of the reflector (*R*) is a small cup, into which a ball connected with the spectacle-frame fits. A ring is screwed over the ball, and the joint is thus formed at *J*.

entirely protecting the observer's eyes from the glare of the

[1] The reflector should not merely be left unsilvered in the centre, but should be actually perforated; otherwise the glass makes a slight focal inequality between the two eyes. Laryngoscopes, made in every respect according to my directions, are sold by Messrs. Mayer and Meltzer, 71, Great Portland Street.

[2] "Laryngoscopie," &c. Berlin, 1874, p. 19.

[3] Loc. cit.

[4] "Die Laryngoscopie." Tübingen, 1873.

[5] Loc. cit.

[6] "Lectures on the Laryngoscope." 1864.

light; for whilst the luminous rays necessarily fall obliquely on the mirror, and therefore do not reach the pupil of the eye immediately behind it, the other eye is also within the shadow of the reflector. It is only in the first position, moreover, that the observer can look through the hole in the reflector; if, therefore, either of the other methods is practised, the reflector need not be perforated. The reflector may be attached to the operator's head, either by a spectacle-frame (Semeleder),[1] or by a frontal band, as recommended by Kramer, and first employed by Bruns.[2] The spectacle-frame, with the upper halves of the rim removed (as seen in Fig. 13), is the arrangement which I have found most convenient. In either case the mirror should be connected with its support by a ball-and-socket joint. The hole in the centre of the reflector should be oblong, and when placed in front of the eye, its long diameter should correspond with the long diameter of the eye. A hole of this shape allows for the varying distance between the nose and eyes in different people, and for the varying position of the centre of the reflector, in

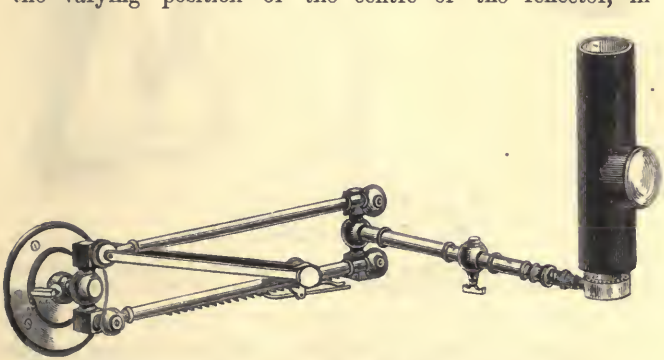

FIG. 14.—THE AUTHOR'S RACK-MOVEMENT LAMP.

The chimney of the lamp is made of metal, a round hole being left where the lens fits in.

its different degrees of inclination. Practitioners who labour under defective vision will find it convenient to have suitable glasses fitted to the spectacle frame of the frontal reflector.

[1] "Die Laryngoscopie," &c. Wien, 1863, p. 13.
[2] Loc. cit. p. 22.

*Illumination.*—Any lamp that gives a bright steady light answers the purpose perfectly well. Many of the most valuable observations have been made with a common "moderator." An argand gas-burner will be found very convenient, especially if constructed on the reading-lamp principle, so that it can be fixed at different heights. My rack-movement laryngoscopic lamp, which readily admits of perpendicular and horizontal movement, will be found to greatly facilitate the management of the light. Its action is shown in Fig. 14. The power of the light is increased by

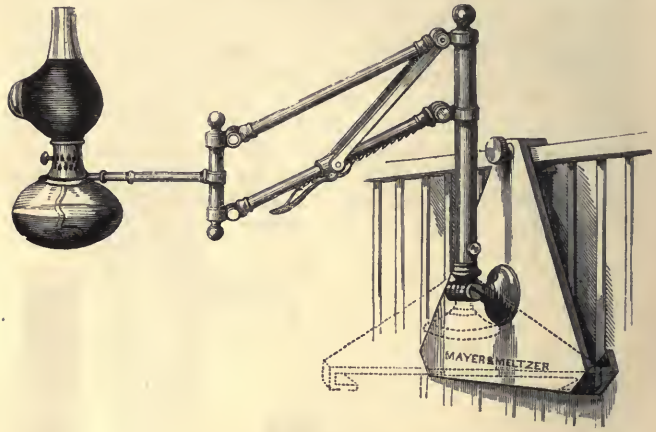


FIG. 15.—THE CLINICAL LAMP.

In the illustration, the lamp is seen hooked on to the horizontal bar of a bed; the dotted lines show the position of the base when the lamp is standing on a table.

a lens placed in front of the flame. My lamp is now used in nearly every hospital in this country where laryngoscopy is systematically employed.

For use at the bedside, where gas is not at hand, my new clinical lamp will be found very serviceable. It has the same action as the rack-movement lamp, but paraffin is used for illumination instead of gas. It makes a very useful lamp for the consulting-room. By reference to the wood-cut (Fig. 15), it will be seen that the base of the apparatus can be hooked on to the bar of a bed, and that the perpendicular stem rotates, so as to adapt itself to this position.

On the other hand, when in use on the table, the stem can be easily adapted to the upright position, by means of the screw at its foot.

In the various lamps or lanterns recommended by different foreign laryngoscopists (Tobold,[1] Moura-Bourouillou,[2] &c. &c.), the arrangement of lenses in each of them is only applicable to the particular lamp for which it was contrived. This serious objection to the various kinds of illuminating apparatus hitherto in vogue, led me to contrive a light-concentrator of more extensive application. It not only gives a very brilliant light, but is at the same time much smaller, and therefore much more

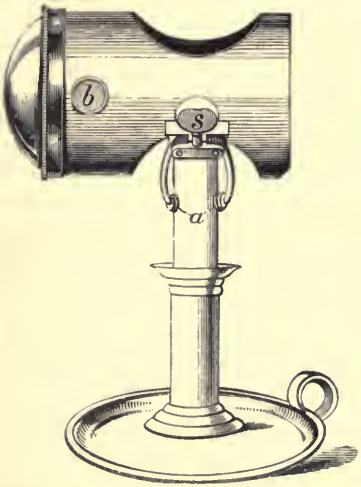


FIG. 16.—THE LIGHT-CONCENTRATOR.

In the drawing, the concentrator is fixed on to a candle by means of two arms (*a*). In using a lamp, the arms embrace the chimney: *s*, screw for tightening the arms; *b*, one of the cork knobs for taking hold of the concentrator when hot.

portable than any of those hitherto in use, and it can be employed with any kind of lamp, or even a candle. It consists of a small metal cylinder, three and a half inches long, and two and a half in diameter. This is closed at one end, and at the other there is a plano-convex lens, the plane

[1] Loc. cit. p. 19.
[2] "Traité pratique de laryngoscopie," &c. Paris, 1864.

surface of which is next the flame. The lens is two and a half inches in diameter, and is about one-third of a sphere. In the upper and under surfaces of the cylinder (opposite each other) are two round apertures, two inches and a quarter in diameter. These holes are not equidistant from the two ends of the tube, but so near to the closed extremity that a line passing perpendicularly through their centres would be about two inches and a half from the plane surface of the lens, and rays of light pass through in comparatively parallel directions. At the lower part of the tube are two semi-circular arms, which, by means of a screw at the side, can be made to grasp tightly the largest lamp-chimney, an ordinary candle, or even the narrow stem of a single gas jet. The practitioner, therefore, who, in visiting patients, carries my light-concentrator, can always feel certain of being able to illuminate the fauces. The apparatus is passed over the chimney, till the centre of the lens is opposite the most brilliant part of the flame, and then, by a few turns of the screw, the concentrator is fixed in position. When a candle is employed, the flame is in the centre of the tube.

In the side of the tube near the lens are two ivory knobs covered with cork, which enable the practitioner to hold the concentrator and remove it from the lamp, even when it is extremely hot. For the consulting-room the light-concentrator may be most advantageously employed either with an argand gas-burner, a paraffine, moderator, or reading lamp. The latter kind of lamp, with an argand gas-burner, will be found convenient, though my rack-movement laryngoscopic lamp is the best that can be employed.

The light of a candle, strengthened by this concentrator, will be found to equal that given by an ordinary lamp. When the practitioner has only a centre gaselier at his command, the light-concentrator should be applied to the only jet which is lighted; and as it is not generally possible to pull a gaselier sufficiently low down to make the examination in the ordinary way, under these circumstances both patient and practitioner must stand upright.

Besides the concentrator just described, I have had a smaller illuminating apparatus constructed, which is called my "miniature light-concentrator." The principle is the same in both; but in the latter the metal cylinder is only two inches in length, and an inch and a half in diameter: it is only suited for the small paraffine lamp, which is sold with it. This lamp, which measures only four inches from

its foot to the top of the chimney, is like a little vial, and has a metal screw stopper, so that it can be carried about with safety.

It has been already observed that the employment of a reflector is not absolutely necessary for throwing a light on to the laryngeal mirror. The solar rays, or diffused light, on a bright day, may be concentrated on the laryngeal mirror. In the former case, the surface of the reflector must be plane; in the latter, the usual concave mirror may be used. The patient should sit with his back turned obliquely to the window, and the practitioner opposite him. The sunlight in this way passes over the patient's shoulder to the reflector, and is thence projected on to the laryngeal mirror. In other respects the examination is conducted in the same way as when artificial light is used.

When the observer does not make use of a reflector, the rays of light must be thrown from a lamp directly into the patient's mouth, or else the luminous rays must be projected from a light in less close proximity by a lens placed in front of the flame. In using an ordinary lamp for direct illumination, either a common plano-convex lens may be used, or a large glass globe about six inches in diameter, filled with water. The latter kind of concentrator (the so-called Schusterkugel) was first recommended by Türck,[1] and afterwards adopted by Stoerk; but, whilst the former soon abandoned its use in favour of the reflector, the latter still employs it almost invariably. This apparatus has been further improved by Dr. Walker, of Peterborough. It gives a brilliant light, which is most intense at about twenty inches from the globe. As it is quite impossible to carry this enormous glass globe about, its use is necessarily confined to the practitioner's consulting-room.

A much more convenient plan is that adopted by several of the French physicians, which may be thus described: A lamp provided with a lens is placed on a table so narrow, that the laryngeal mirror can be used by the practitioner on a patient sitting on the opposite side of the table. A shade screens the light from the observer's eyes, whose face, in this mode of examination, is close to the lamp. In applying remedies, the lamp is between the arms of the practitioner, who, as it were, embraces it. Dr. Fauvel, of Paris, uses a table about three feet long and one foot broad, in three

[1] "Zeitschrift der Gesellschaft der Aerzte," Nro 8, 1859, und "Allgem. Wien. Med. Zeitung," Nro 15, 1859.

leaves; the centre leaf, on which a moderator lamp rests, can be screwed up and down to different heights for different patients. Dr. Krishaber[1] employs a simple round table of small dimensions.

For direct illumination the oxy-hydrogen lime light is by far the best that has yet been invented, and is especially adapted for demonstrations of cases to a number of persons. Not only is the light superb, but the mode of illuminating is much less fatiguing to the operator when a large number of cases have to be seen, and the heat, if not actually less, is less felt on account of its being further removed from him.[2]

*Magnifying Instruments.*—Various instruments have been invented for increasing the size of the laryngeal image, but they are of no use in the treatment of disease. As early as 1859, Dr. Wertheim, of Vienna, recommended concave laryngeal mirrors for this purpose; and later, Dr. Türck,[3] calling attention to the fact that the laryngeal image is made up of a number of parts at different distances, suggested the use of a small telescope which he had fitted to his illuminating apparatus. Finally, Voltolini[4] made some further improvements in the apparatus.

*Micrometers.*—For measuring the exact size of different parts of the larynx, and for estimating distances, Merkel,[5] of Leipzig, and Mandl,[6] of Paris, have suggested the plan of having a scale scratched on the laryngeal mirror. Dr. Semeleder[7] objected to this mode of measuring, as it takes so much away from the reflecting surface of the mirror, and recommended that the scale should be drawn on the frame of the mirror. Though these scales might, perhaps, be advantageously employed for physiological investigations, they are of no use to the medical practitioner.

*Laryngoscopic Chairs, Head-rests, &c.*—Most people, when they are about to have the throat examined, lean back in the chair, throw up the head, and open the mouth. This attitude, however, is very ill suited for laryngoscopy, where

[1] "Dict. Encyclop. des Sciences Médicales." Paris, 1868.

[2] A full description and illustration of this method of illumination will be found in my work on "The Laryngoscope," 3rd edition, p. 46.

[3] "Klinik der Krankheiten des Kehlkopfs," &c. pag. 137, Wien, 1866.

[4] "Galvano caustik," p. 93.

[5] "Die Funktionen des menschlichen Schlund—u. Kehlkopfes," p. 5. Leipzig, 1862.

[6] "Traité pratique des Maladies du Larynx," &c. p. 115. Paris 1872.

[7] Loc. cit. p. 27.

both the head and body should be kept erect. In many cases also—especially where the patient is at all nervous—in applying remedies to, or operating on, the larynx, it is very desirable to be able to steady the head. I now use in private practice a narrow-seated high-backed chair (Fig. 21). The seat measures only a foot in depth, and the back is thirty-four inches high. This kind of chair obliges the patient to sit upright, and greatly assists in steadying the head. I formerly employed a head-rest (Fig. 17), very much like that employed by photographers, except that instead of having a stand of its own, it is fixed to an ordinary chair. A strong metal plate, terminating in a ring behind, is screwed to the under surface of the frame which supports the seat;

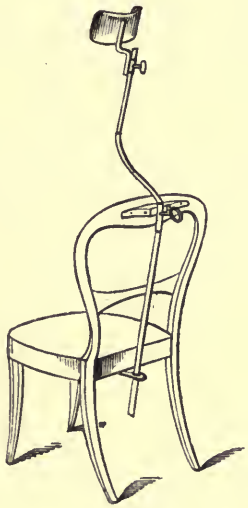

FIG. 17.—THE HEAD-REST.

and another similar projecting ring is screwed to the top bar of the chair. A strong iron bar passes perpendicularly through these rings; just above the upper ring it bends obliquely forwards for about half a foot, and then again passes perpendicularly upwards for another foot. This bend in the bar prevents the patient leaning back. Sliding on the perpendicular bar, is a broad, curved, semicircular pad, which supports the head, and can be fixed at any height. It allows

the patient to raise his head, but prevents any movement backwards or laterally. The apparatus is not unsightly, if the metal part is made of brass; and when the support is not required, the perpendicular bar and head-rest can be altogether put away.

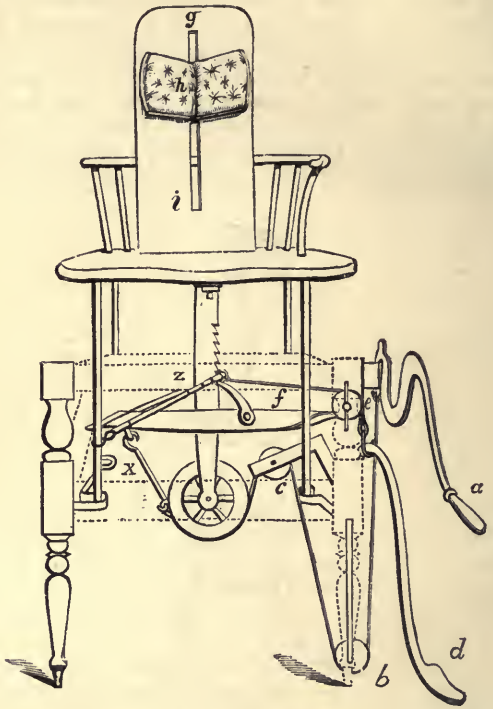


FIG. 18.—LARYNGOSCOPIC CHAIR, ESPECIALLY ADAPTED FOR HOSPITAL PURPOSES.

At *a* a lever of the second kind is brought into play through *b* and *c*, the fulcrum being at *x*. By pressing on the handle *a*, the patient is at once raised to the desired elevation. On the other hand, by pressing on *d* with the foot, the operator withdraws the bolt *f* from the rack *z*, and the chair gradually descends. There is a narrow backboard (*g*) with a moveable head-rest (*h*), which slides up and down the groove (*i*), and can be fixed at any height by a screw at the back.

For hospital practice, and especially when the oxy-hydrogen light is used, the laryngoscopic chair represented in Fig. 18 will be found the most convenient. It enables the operator to raise or lower the patient without rising from his seat.

## LARYNGOSCOPY.

The only principle concerned in the art of laryngoscopy is the optical law, that when rays of light fall on a plane surface, the angle of reflexion is equal to the angle of incidence. A small mirror is placed at the back of the throat, at such an inclination that luminous rays falling on it are projected into the cavity of the larynx; at the same time the image of the interior of the larynx (lighted up by the luminous rays) is formed on the mirror, and seen by the observer. The mirror is held obliquely, so that it forms an angle of rather more than 45° with the horizon. The plane of the laryngeal aperture (bounded by the epiglottis, the ary-epiglottic folds, and the arytenoid cartilages), is also oblique, the epiglottis being higher than the apex of the arytenoid cartilage.

The annexed diagram shows the position of the different parts, and explains their reflexion. Let *m* represent the plane of the larnygeal mirror, *l* the plane of the upper opening of the larynx, and *o* the observer. In the plane of

FIG. 19.—DIAGRAM SHOWING THE RELATIVE POSITIONS OF THE PLANES OF THE LARYNX AND LARYNGEAL APERTURE.

the larynx, *a* represents the arytenoid cartilages, *ae* the ary-epiglottic folds, and *e* the epiglottis; the rays from these parts impinge on the mirror, as *á*, *aé*, and *é*, and are thence reflected to the observer at *o*. Thus the epiglottis, which is really the highest in the throat, appears at the upper part of the mirror, the ary-epiglottic folds appear rather lower and at each side of the mirror, whilst at the lowest part of the mirror are the arytenoid cartilages. These remarks apply to the vertical reflexion.

The only inversion which takes place in the formation of

the image is in the antero-posterior direction ; the part which in reality is nearest to the observer, the anterior commissure of the vocal cords (*ac* in B, Fig. 20), becomes furthest in the

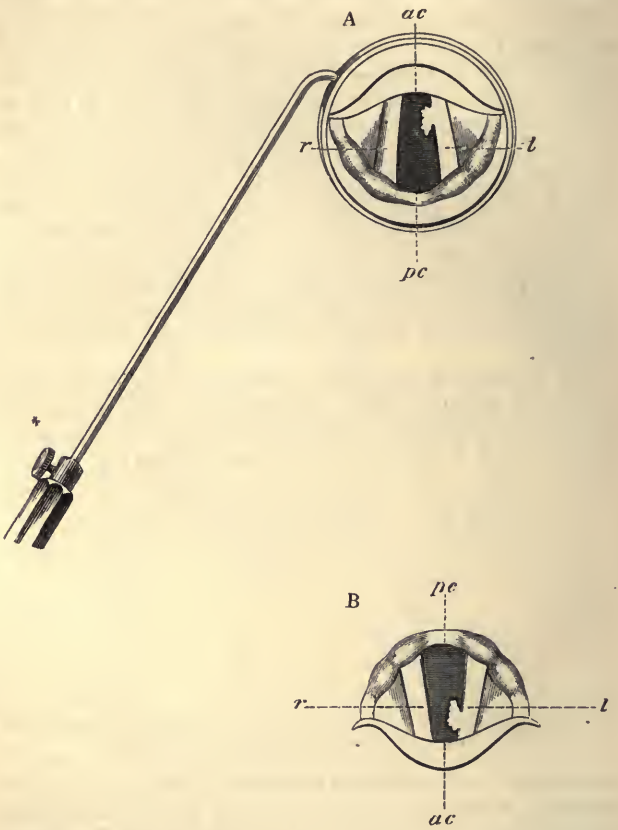


FIG. 20.—DRAWING SHOWING THE RELATION OF PARTS IN THE LARYNX (*B*), AND THE LARYNGEAL MIRROR (*A*).

*ac*, anterior commissure of the vocal cords; *pc*, posterior commissure of the vocal cords; *r*, right vocal cord; *l*, left vocal cord, with a wart on it.

image (*ac* in A, Fig. 17), and the posterior commissure, *pc*, which, in reality, is farthest from the observer, becomes

nearest in the image.[1] The symmetrical character of the image, which makes it impossible to judge of right and left, and this antero-posterior inversion which actually takes place, often lead people to form erroneous opinions concerning the two sides of the larynx.

The lateral relation of parts in the image must now be considered. The mirror being placed above and *behind* the laryngeal aperture, the rays of light proceeding from the larynx pass directly upwards and backwards, and the patient's right vocal cord is seen on the left side of the mirror, and the left vocal cord on the right side of the mirror (just as the patient's right hand is opposite the observer's left, and his left hand opposite the observer's right). In the annexed cut (Fig. 20), a wart is seen on the left vocal cord of the larynx (B) ; this is opposite the observer's right hand, and it appears on the same side in the image (A). In consequence, however, of the antero-posterior inversion which takes place, as explained in the last paragraph, if the fact that the representation of the larynx (A) is an image is not borne in mind, it would lead to the deceptive idea that the wart was on the right vocal cord. In examining a laryngoscopic drawing, a person must not make his own larynx the mental standard of comparison as regards right and left, but must recollect that the picture represents an image formed on a mirror held obliquely above and rather *behind* the larynx of another person.

In making a laryngoscopic examination there are three stages.

*First Stage.*—The patient should sit upright, facing the observer, with his head inclined very slightly backwards. The observer's eyes should be about one foot distant from the patient's mouth, and a lamp burning with a strong clear light should be placed on a table at the side of the patient, the flame of the lamp being on a level with the patient's eyes. The observer should now put on the spectacle-frame with the reflector attached, and directing the patient to open his mouth widely, should endeavour to throw a disk of light on to the fauces, so that the centre of the disk corresponds with the base of the uvula. If the observer has much trouble in projecting the light on to the fauces, he will find it convenient to incline the

[1] This is in accordance with the fundamental optical law :— That if a diverging pencil of light fall upon a plane reflecting surface, the focus of the reflected pencil will be at the same distance from the surface as that of the incident pencil, but on the opposite side of it.

reflector at a suitable angle before putting on the spectacle-frame. This may be done as follows: Taking the spectacle-frame in the hand, with the mirror attached, so that the central aperture in it would come opposite to the pupil of the operator's right eye, and fixing the joint so that the back of the mirror is parallel with the spectacle-frame, the outer edge of the reflector should be pushed rather more than a

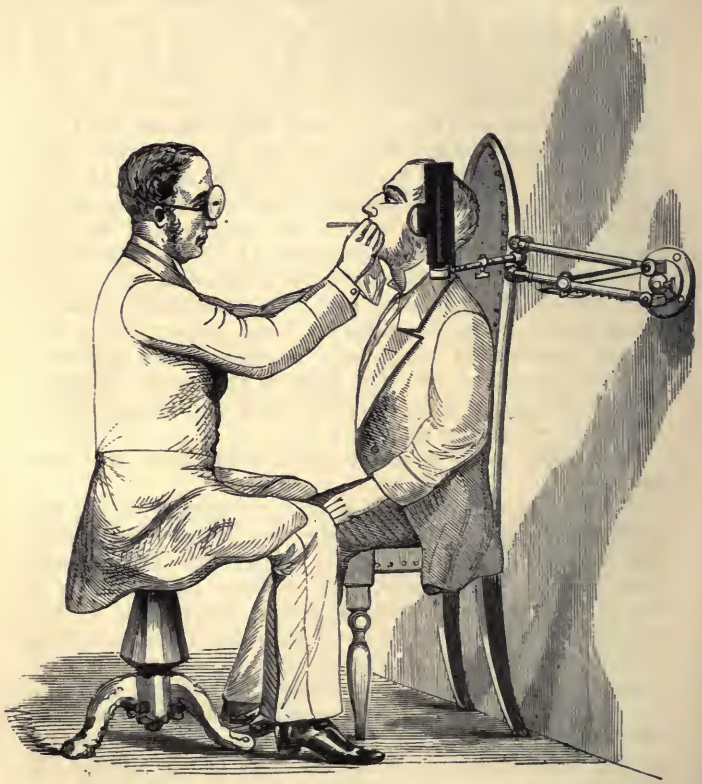

FIG. 21.—LARYNGOSCOPY—THIRD STAGE, SHOWING POSITION OF PRACTITIONER AND PATIENT.

quarter of an inch forwards or backwards, according as the lamp is on the right or left side of the patient. If the observer has chosen his position and placed the lamp as directed, on

putting on the spectacle-frame, a beautiful luminous disk will

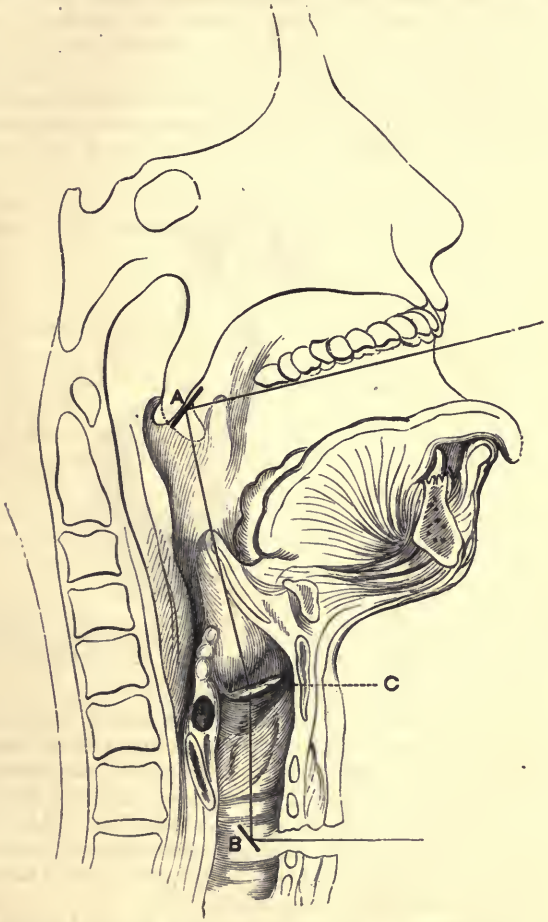


FIG. 22.—DIAGRAM SHOWING THE ANGLES OF INCIDENCE AND REFLEXION IN ORDINARY, AND INFRA-GLOTTIC, LARYNGOSCOPY.

A. Side view of mirror, when properly introduced. It is seen to push back the uvula towards the posterior nares. B. Side view of infra-glottic mirror. C. Left vocal cord.

appear at the back of the throat. When direct light is used,

the first stage is much simplified, as the patient has only to sit opposite the lens of the lamp, as described at page 223.

*Second Stage.*—The patient should be directed to put out his tongue, and the observer should hold the protruded organ gently but firmly between the finger and thumb of his left hand, the thumb being above and the finger below. To prevent the tongue slipping, the observer's hand should be previously enveloped in a small

FIG. 23.—THE POSITION OF THE HAND AND MIRROR, WHEN THE LATTER HAS BEEN PROPERLY INTRODUCED FOR OBTAINING A VIEW OF THE LARYNX.

soft cloth or towel, and he should be careful to keep his finger rather above the level of the teeth, in order that the frænum may not be torn. The position of the practitioner and patient is shown in Fig. 21. In cases that are likely to require local treatment, the patient should be taught to hold out his own tongue, so that the operator may be able to introduce the mirror with his left hand, whilst with the right he applies the remedy to the affected part.

*Third Stage.*—When the observer has practised the first two stages, he should take a small laryngeal mirror, about half an inch in diameter, and after warming its reflected surface for a few seconds over the chimney of the lamp (to prevent the moisture of the expired air being condensed on it), should introduce it to the back of the throat. In holding a mirror over a lamp, the little glass is first covered with a film of

moisture, which quickly clears away. Directly the glass is clear, it is the right temperature—neither too hot nor too cold —to be introduced. Before introducing the mirror, however, lest it should be accidentally too hot, the practitioner should test its temperature by placing it on the back of his hand. Supposing that the various steps already described have been followed, and that there is a steady disk of light on the base of the uvula, the laryngeal mirror should now be introduced; but no attempt should ever be made unless perfect illumination has first been effected. To pass the mirror to the back of the throat with as little annoyance as possible to the patient, the following method should be adopted: The handle of the mirror should be held like a pen in the right hand, and quickly introduced to the back of the throat, its face being directed downwards, and kept as far as possible from the tongue in the median line of the mouth (Fig. 23). The posterior surface of the mirror should rest on the uvula, which should be pushed rather upwards and backwards, towards the posterior nares (Fig. 22). When the mirror has thus been introduced without irritating the fauces, the observer should raise his hand slightly and direct it outwards towards the corner of the mouth. This rotatory movement, which alters the inclination of the mirror, and turns its face more towards the perpendicular (whilst the hand is thereby kept entirely out of the line of vision), should be effected rather slowly, so that it can be arrested directly the larynx comes into view. After introducing the mirror, the observer can, if he chooses, steady it, by resting the third and fourth fingers against the patient's cheek. The exact angle which the mirror should bear to the laryngeal aperture must depend on a number of circumstances, such as the degree of flexion backwards of the patient's head; the particular angle which the plane of the laryngeal aperture bears to the horizon in the case undergoing inspection; and on the direction which the ray must take to reach the observer's eye—that is to say, on the position of the observer (Fig. 23). The practitioner should learn to introduce the mirror with either hand, for by so doing any false ideas concerning a supposed asymmetrical condition will be at once corrected; and whilst, for the purpose of diagnosis, it is very desirable to be able to use either hand, in the application of remedies to the larynx, ambidexterity is absolutely essential.

Beginners, in their anxiety to get a good view, often give rise to faucial irritation, by keeping the mirror too

long in the patient's mouth ; but one of the commonest mistakes made by those unpractised in the use of the laryngoscope, consists in introducing the laryngeal mirror before the disk of light has been steadily concentrated on the base of the uvula. The imperfect illumination causes the operator to touch the back of the throat in several places before it is put on the right spot. Again, beginners often lose the light, even after they have thrown the rays in the first instance in the proper direction ; under these circumstances, instead of withdrawing the laryngeal mirror and redirecting the light on to the centre of the fauces, as the skilled laryngoscopist would do, the beginner moves his head (which supports the frontal mirror) in the hope of thus being able to throw the light to the right place, the laryngeal mirror being kept in the meantime in the patient's throat, where it is certain to cause irritation. This is a fatal error. The practitioner should recollect that when an act of retching has once taken place, it is afterwards often impossible to get a good view of the larynx at the same sitting. Moreover, the act of retching always causes considerable temporary congestion of the laryngeal mucous membrane, and thus is apt to lead the inexperienced to very erroneous conclusions. It is, therefore, better to introduce the mirror any number of times, keeping it in the throat only for a few seconds each time, than to let it remain longer, and thus limit the examination to one inspection. The novice must be careful to avoid touching the tongue with the mirror, for this procedure irritates the throat and spoils the reflecting surface of the mirror for the time. This can generally be avoided by keeping the back of the mirror in close proximity to, but not letting it touch, the palate. In some people, however, the uvula is in actual contact with the back of the tongue, and as in inspiration or vocalization the uvula is raised, such patients should be directed to inspire deeply, or to produce some vocal sound (such as "ah," "eh," "oh," &c.) ; the mirror can then be easily slipped in between the uvula and the tongue. All violence or even roughness must be carefully avoided, the tongue must be held out most gently, and the laryngeal mirror placed very lightly on the uvula. Complicated instruments for holding the mouth open almost invariably lead to failure.

*Special Difficulties.*—The difficulties solely dependent on the practitioner's want of dexterity have been already considered, but a few words must be devoted to those in part due

to the patient. The obstacle may be either undue irritability of the fauces, a peculiar action of the tongue, an abnormal size of the tonsils, or a pendent condition of the epiglottis.

As regards faucial irritability, it is to be observed that though this condition sometimes exists of itself, it is far more often caused by the clumsiness or inexperience of the practitioner. Most patients can be examined with facility at the first sitting, and only a small proportion require any training. With timid patients—especially women—on first using the laryngoscope, it is well to place the mirror for a second on the back part of the palate, without being too particular about seeing anything. By introducing the mirror once or twice in this way, the patient's confidence is secured, and a more fruitful examination may afterwards be made. For reducing an unusually irritable condition of the fauces, we may have recourse to several expedients, in order to enable the patient to tolerate the introduction of the laryngeal mirror. Bromide of potassium is generally supposed to have the power of producing anæsthesia of the pharynx, but the effects of this drug are too uncertain to meet the wants of the laryngoscopist. The method of frequently painting the mucous membrane with chloroform, ether, or solution of morphia recommended by Türck [1] and Schroetter,[2] is tedious and attended with the danger of producing serious general narcotism. Von Bruns [3] advises that the pharynx should be sprayed with a solution of tannin, or pencilled with a mixture of tannin and glycerine. When, however, the practitioner requires to make an immediate inspection of the larynx, his object may almost always be accomplished by directing the patient to suck small pieces of ice continuously for fifteen or twenty minutes. This remedy rarely, if ever, fails to blunt for a short time the ordinary sensitiveness of the mucous membrane. In cases, where it is necessary to carry out a prolonged local treatment of the larynx, as in the removal of growths, the patient may be directed to practise on himself daily with the laryngeal mirror.

The conformation of parts occasionally causes some difficulty. Thus, when the tongue is drawn out, it sometimes forms an arched prominence behind, which causes trouble in introducing

[1] "Klinik der Krankheiten des Kehlkopfs." Wien, 1866, p. 551, et seq.

[2] "Jahresbericht," &c. (op. cit.), 1870, p. 34.

[3] "Die Laryngosk. u. die Laryngosk. Chirurgie." Tübingen, 1865, p. 53.

the mirror, and difficulty in seeing it when *in situ*. This position of the tongue is due to reflex action, and will be best avoided by pulling the tongue less forward than usual, keeping it level with the mouth (that is to say, not holding it down towards the chin), and by cautioning the patient not to strain.

Enlarged tonsils sometimes embarrass the operator. In this condition a small oval mirror should be used. An unusually large or pendent epiglottis causes a more serious impediment to laryngoscopy. When the valve is very large, it sometimes shuts out the view of the larynx; but the same result is more often caused by unusual length or relaxation of the glosso-epiglottic ligaments. In the production of high (falsetto) notes, the epiglottis is generally raised, and this also happens when a person laughs; the observer will, therefore, do well to take advantage of these physiological facts. In a certain number of cases, however, the epiglottis remains obstinately pendent. For elevating the valve in these cases, various instruments have been invented, but they seldom prove of any service. Some of the German laryngoscopists recommend that a thread should be passed with a curved needle through the epiglottis. An assistant, standing behind the patient, draws the thread over the patient's face and head, or the opposite end of the thread may be tied round one of the patient's ears. Most of the instruments hitherto invented, however, cause so much irritation that they cannot often be employed with advantage.[1] When the epiglottis covers the larynx in the manner described, the laryngeal mirror should be introduced lower in the fauces, and more perpendicularly than is usually suitable. In almost all cases the arytenoid cartilages, surmounted by the capitula Santorini, can be seen, and from them we can judge with tolerable certainty as to the mobility of the vocal cords; the state of the mucous membrane of the larynx in other parts cannot, however, be safely inferred from the condition of that which covers the arytenoid cartilages.

[1] See Türck: "Klinik der Kehlkopfskrankheiten." Wien, 1866, p. 551, et seq.; Tobold: "Laryngoscopie." Berlin, 1874, p. 449, et seq.; Oertel: "Deutsches Archiv für klin. Medicin," vol. xv., Heft 3 and 4; and my work on the "Laryngoscope." Third Edition, p. 85.

## Auto-Laryngoscopy.

Those who desire to acquire dexterity in introducing the mirror at their own expense, rather than that of their patients, and those who wish to demonstrate their larynx to others, should learn to employ the laryngoscope on themselves.

When auto-laryngoscopy is practised, it is requisite that, besides the circular reflector and laryngeal mirror, another mirror should be used: this must be placed in such a position that the image reflected in it from the throat-mirror can be seen by the autoscopist. For practising auto-laryngoscopy, Professor Czermak [1] contrived a special apparatus. It has a large reflector and quadrilateral mirror, each supported on perpendicular bars. These mirrors are fixed about a foot apart, and both can be turned in almost any direction, and fixed at any height. In using this apparatus, the observer should sit at a table with the quadrilateral mirror a few inches in front of his mouth, and the reflector a foot further back, the upper edge of the square mirror being level with the lower edge of the reflector behind it. The flame of the lamp should be near, but a little behind and to the side of, the quadrilateral mirror. The observer now throws the light into his fauces with the reflector, introduces the warmed laryngeal mirror, and sees the image in the quadrilateral glass. People facing the demonstrator can see the image in the laryngeal mirror, and those behind him in the one which he looks at. For those who wish to make accurate physiological observations, this is the best method of practising auto-laryngoscopy. Those who object to purchase a special apparatus can use the ordinary reflector for auto-laryngoscopy. In this case, all that is requisite is a perpendicular telescope-bar, capable of being made about a foot and a half in length, and having a broad firm base: at the top of the bar is a small projecting ball, which fits into the socket at the back of the ordinary reflector. The reflector is placed on a table, at about eighteen inches from the observer, between whom and the reflector there must be a small toilet mirror or hand-glass. In other respects, the examination must be conducted as already described.

A simpler method of practising auto-laryngoscopy is that recommended by Dr. George Johnson.[2] The observer puts on

[1] Loc. cit. pp. 1 and 28 (with illustration). [2] Loc. cit.

his ordinary reflector, as though he were going to examine a patient, and sits facing a toilet mirror. A lamp is placed on one side of the observer, in a line with the mirror, or slightly behind it, and by manipulating the reflector the observer now throws the light on to the image of his fauces, as seen in the toilet-glass. He then introduces the laryngeal mirror into his throat, and the image of the larynx formed on it is seen in the toilet-glass, both by the demonstrator and by the persons standing behind him. In practising auto-laryngoscopy in this manner, the practitioner has to manage the light in the same way as in examining patients, and he thus learns to overcome one of the difficulties of laryngoscopy. The only disadvantage of this method, as compared with that of Czermak, is that, by it, the rays of light undergo an additional reflexion before they reach the larynx, and thus the image is not quite so distinct.

### Infra-glottic Laryngoscopy.

Where tracheotomy has been performed, and a fenestrated canula is worn, a very minute mirror may be introduced through the tube with its face directed upwards; or the canula may be removed, and the mirror passed into the wound (Fig. 22, p. 231). In this way the observer obtains a view of the larynx from below.

This method was first suggested by Dr. Neudörfer,[1] in 1858, and was first carried out by Professor Czermak[2] in the following year. Since then, various observers have examined patients in this way, and I have myself often had the opportunity of employing the mirror from below. Some interesting observations made by a medical man on himself have been recorded by Dr. Semeleder.[3] This mode of examining the larynx, though of very limited application, is valuable, because it generally happens, in cases where a canula is worn, and air is inspired mainly through the trachea, that the epiglottis does not rise up, but remains pendent, in inspiration; in post-tracheotomy cases, also, it often happens that the epiglottis is bound down over the larynx by old cicatrices, and consequently ordinary laryngoscopy is useless. It is well to remark that the vocal cords, when observed from below, have a reddish colour, and do not present the peculiar white appearance which is seen when the laryngeal mirror is placed on the uvula.

[1] "Oesterreich. Zeitschrift für pract. Heilkunde." 1858, Nro 46.
[2] "Wiener Med. Wochenschrift." 1859, Nro 11. [3] Loc. cit. p. 24.

## THE LARYNGEAL IMAGE.

The rationale of the formation of the image having already been explained (page 227), the special description of its individual parts will be now undertaken. In some cases, on introducing the laryngeal mirror, only the epiglottis may be visible, with perhaps just the tips of the capitula Santorini at the posterior part; whilst in others, the entire length of the vocal cords, the ventricular bands, the small cartilages of Wrisberg and Santorini, a portion of the cricoid cartilage, the rings of the trachea, and perhaps even the bifurcation of the bronchi below it, can be seen with perfect distinctness. The view varies in different cases between these two extremes.

The *epiglottis* varies very much in appearance in different individuals. In some cases it is broad, whilst in others it is extremely narrow; in some only the upper surface can be seen, in others, where the epiglottis is drawn tightly to the tongue, only the under surface is visible. In the centre of the free edge is a slight notch, which gives to the epiglottis, when seen in its entirety, its foliate appearance. But the free edge of the valve is more often turned upon itself, so that in the reflexion the notch is lost sight of, and the border appears round. In some cases, on account of the inclination of the epiglottis, only the profile of its free edge is visible in the mirror. In these cases the valve is represented by a thin line. As a rule, there is seen (Figs. 24 and 25)—1st, A portion of its upper surface on either side (*u*); 2ndly, its free edge and a small portion of its under surface turned up in the centre, and forming a kind of lip (*l*); and 3rdly, another portion of its under surface, below and behind the lip, projecting as a rounded prominence —the cushion (*c*). The upper surface is of a dull pinkish hue; the lip is of a decided yellow colour, though it has a slight shade of pink; and the cushion is invariably bright red. In some cases the whole of the under surface of the epiglottis is seen, and then it is of a bright red colour. This normal coloration of the under surface of the epiglottis is apt to be mistaken (by those unaccustomed to the use of the laryngoscope) for congestion of the mucous membrane. Above the epiglottis, the glosso-epiglottic folds (*g e*) may be seen, passing upwards and backwards to the tongue, the posterior superior border of which appears as a horizontal uneven line.

The *ary-epiglottic folds* (*ae*) which form the lateral boundaries of the upper laryngeal aperture, can be seen in the mirror extending obliquely downwards and backwards from the epiglottis to the arytenoid cartilages. Near the latter are the slight pinkish prominences of the *cartilages of Wrisberg* (*cW*), and a little beyond the cartilages of Wrisberg, in the same fold of mucous membrane, are two other small prominences, the *capitula Santorini* (*cS*), surmounting the arytenoid cartilages.

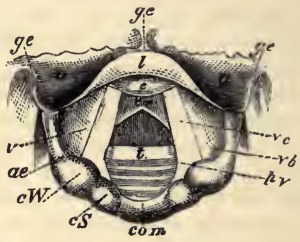


FIG. 24.—LARYNGOSCOPIC DRAWING, SHOWING THE VOCAL CORDS DRAWN WIDELY APART, AND THE POSITION OF THE VARIOUS PARTS ABOVE AND BELOW THE GLOTTIS, DURING QUIET INSPIRATION.

*g e.* Glosso-epiglottic folds.
*u.* Upper surface of epiglottis.
*l.* Lip of epiglottis.
*c.* Cushion of epiglottis.
*v.* Ventricle of larynx.
*a e.* Ary-epiglottic fold.
*cW.* Cartilage of Wrisberg.
*c S.* Capitulum Santorini.
*com.* Arytenoid commissure.
*v c.* Vocal cord.
*v b.* Ventricular band.
*p v.* Processus vocalis.
*c r.* Cricoid cartilage.
*t.* Rings of trachea.

FIG. 25.—LARYNGOSCOPIC DRAWING, SHOWING THE APPROXIMATION OF THE VOCAL CORDS, AND THE POSITION OF THE VARIOUS PARTS IN THE ACT OF VOCALIZATION.

*fi.* Fossa innominata.
*sp.* Sinus pyriformis.
*ch.* Cornu of hyoid bone.
*cW.* Cartilage of Wrisberg.
*cS.* Capitulum Santorini.
*a.* Arytenoid cartilages.
*com.* Arytenoid commissure.
*pv.* Processus vocalis.

The *cartilages of Wrisberg* generally appear round, but sometimes, especially in thin people, they have a triangular shape—the apex of the triangle being directed outwards. The capitula Santorini have a roundish shape in the healthy larynx, and like the cartilages of Wrisberg are most distinct when the vocal cords are approximated. But the clearness with which these small laryngeal cartilages can be seen, depends also upon their degree of development, and upon the amount of submucous areolar tissue surrounding them; sometimes the cartilage of Wrisberg is not to be seen at all, whilst occasionally there is a small cartilage between it and the capitulum Santorini. The breadth of the ary-epiglottic folds varies in different people and in different states of the larynx, being greater when they are relaxed, that is, in inspiration, and narrow when they are tense, as in the approximation of the cords—especially in the production of high notes. The ary-epiglottic folds have been well described by Stoerk, as having almost the same colour as the gums. The cartilages of Wrisberg and Santorini are of a rather brighter and deeper colour than the rest of the mucous membrane.

The *arytenoid cartilages* (*a*) are easily recognized by the small cartilages of Santorini which surmount them. They can be best seen when the vocal cords are approximated. The mucous membrane covering them is generally of a rather redder tinge than that forming the ary-epiglottic folds. Between the arytenoid cartilages is a fold of mucous membrane, the inter-arytenoid fold or commissure, which is most apparent when the glottis is widely open (Fig. 24, *com*); when the arytenoid cartilages are approximated, the commissure folds together, and is directed backwards (Fig. 25, *com*). It is of a yellowish-pink colour.

The *ventricular bands* (*vb*), formerly called the false vocal cords, are the folds of mucous membrane which are seen below the ary-epiglottic folds, passing obliquely in the antero-posterior diameter of the larynx, from the arytenoid cartilages to the epiglottis. They are thick, rather prominent, and of a deeper red colour than the ary-epiglottic folds. Being rather thinner, and more prominent at their lower edge (which borders on the ventricle) than elsewhere, this part has a lighter tint when illuminated than the rest of the ligament. When the vocal cords are approximated a small depression—the fossa innominata (*fi*)—may be seen near the epiglottis between the ventricular bands below and the ary-epiglottic folds above.

The openings of the ventricles (*v*) can sometimes be distinguished as dark lines, between the ventricular bands and vocal cords. They are best seen in the healthy larynx of a thin subject—especially when there is a slight disposition to spasm.

The *vocal cords* (*vc*) when visible, cannot be mistaken. They appear as two pearly-white cords, passing from the base of the arytenoid cartilages to the angle of the thyroid cartilage. On inspiration, they appear almost to touch each other at their anterior insertion, but to be separated from a quarter to half an inch posteriorly. On phonation, they become parallel, and appear to approximate. Each vocal cord is seen to terminate behind in the angle at the base of the arytenoid cartilage, called the vocal process (*vp*). On inspiration, this angle is directed outwards, and the glottis has a lozenge shape; but when the vocal cords approach one another, the angle is turned inwards. This process divides the inter-cartilaginous and inter-ligamentous portions of the glottis.

Below the vocal cords, appears the broad yellow *cricoid cartilage* (*cr*), and below it, again, the rings of the trachea (*t*) are seen elevating the mucous membrane, which between them is of a pale pink colour. Occasionally, two indistinct dark circles (the openings of the bronchi), on either side of a bright projecting line (the angle of division between the bronchi), indicate the bifurcation of the trachea, and in some rare cases a ray of light may even be thrown down the right bronchus.

Though external to the larynx, it is necessary to mention the *sinus pyriformis* (*sp*) in which foreign bodies are extremely likely to become lodged. It is bounded on the inner side by the ary-epiglottic folds, and on the outer side by the inner surface of the thyroid cartilage.

## LARYNGEAL INSTRUMENTS.

In operating within the larynx the laryngeal mirror should be held in the left hand, and the instrument in the right. It is seldom necessary to employ an assistant to steady the head, except in the case of very young children. Before describing the various instruments in detail, I may observe that whilst most Continental practitioners, as a rule, use laryngeal instruments curved like a catheter, from the first I employed those of a more angular form, and this type is

universally used in England, and pretty generally in America. In a catheter the two extremities are at right angles to each other; but the angle is reduced to a minimum by a large curve or sweep. This curve, though well adapted for the urethra, is much less suitable for the larynx; and if, on the other hand, the right angle, slightly smoothed down, is left, the instrument in passing into the larynx is kept free of the epiglottis. My meaning will be at once clear on reference to Fig. 44. It will be seen that both the catheter-curved instrument (indicated by dotted lines), and my rectangular instrument reach the same spot; but whilst the former touches, and even presses against the epiglottis, the latter avoids it. Hence the superiority of the rectangular instrument.

*Probes.*—It occasionally happens that it is desirable to introduce sounds within the larynx. By means of such instruments the origin and density of a growth may sometimes be ascertained, when with the unaided laryngeal mirror the

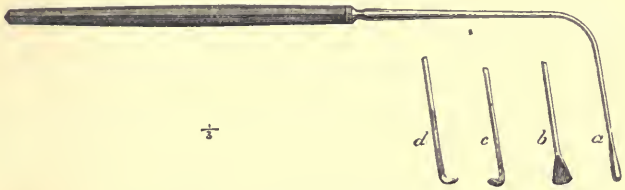


FIG. 26.—LARYNGEAL PROBES.

information cannot be obtained. In cases of ulceration over the arytenoid cartilages they often enable the practitioner to ascertain the extent of the burrowing and the condition of the cartilages themselves. In cases of altered sensibility of the larynx, relative differences may be ascertained.

*Brushes.*—For applying solutions to the larynx, squirrel's or camel's-hair pencils, either cut square at the end or pointed, according as a large surface or small spot has to be touched, and firmly attached to aluminium wire bent at an angle of about 90°, will be found most suitable. Brushes of different lengths and sizes are required, according to the situation and nature of the case. For ordinary use, three brushes will be sufficient, and these are made of definite dimensions. The shortest size (No. 1) measures two inches in length from the angle to the end of the brush. The length in the medium size (No. 2) from the angle is two inches and a half. In the longest (No. 3) the length is three inches. In

all cases the metal shank of the instrument between the handle and the angle should measure at least an inch, and the wooden handle about seven inches. The handle should be octagonal, and should taper down towards the metal; and in hospital

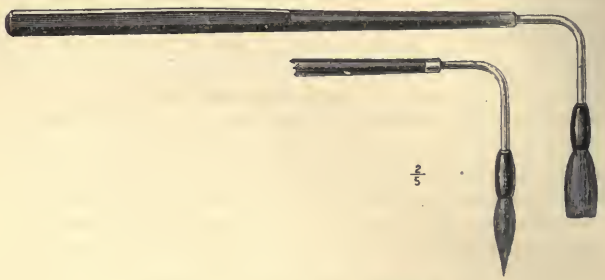

Fig. 27.—Laryngeal Brushes.

practice, or where a large number of cases are seen, it saves a good deal of trouble in sorting and selecting to have the handles of brushes Nos. 1, 2, and 3 coloured, white, red, and black respectively. The Croup-Brush (Fig. 28) is made of

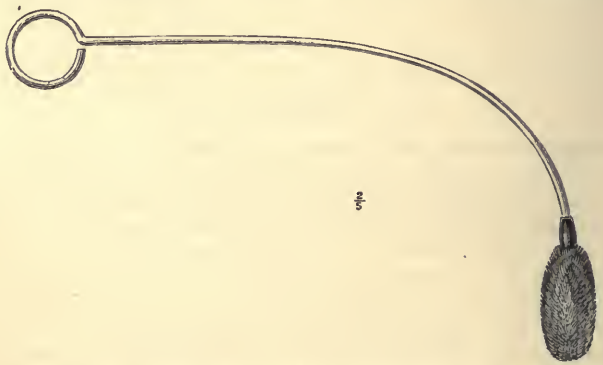

Fig. 28.—The Croup-Brush.

squirrel's tail, and the hairs *covering the sides of the brush* are directed *upwards*. It is mainly useful for detaching false membrane from the larynx and trachea in croup, but it may be employed for applying remedies in the case of children—when the laryngoscope cannot be used.

Sponges were at one time much used by Dr. Fauvel,

of Paris, for applying solutions to the larynx, and they possess the advantage that a perfectly new sponge can be used for each patient at every visit. I have lately employed a very excellent American sponge-holder in this way, after having slightly modified the instrument in order to make it quite safe. To prevent the possibility of the sponge dropping, I have added a

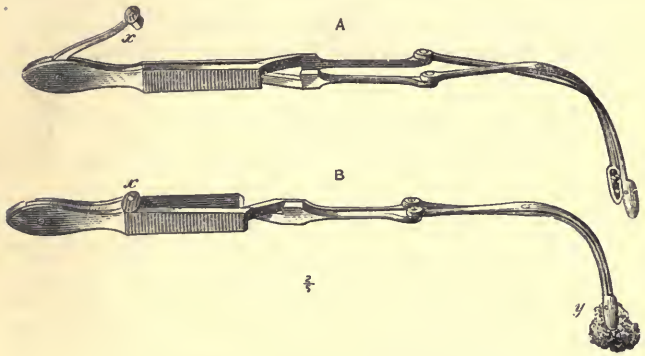


FIG. 29.—THE SPONGE-HOLDER.

A, the holder open. B, the holder with sponges. (The safety-wedge (*x*) is raised in A, but closed in B.)

wedge, which fixes the blades of the sponge-holder immovably together. Dr. P. C. Smyly, of Dublin, uses cotton wool attached to a piece of bent aluminium wire by means of strong thread; the instrument is thrown aside after being once used, and fitted with a fresh piece of wool for each occasion.

*Laryngeal Injectors.*—Various kinds of syringes have been invented for injecting fluids into the laryngeal cavity. I do not recommend this method of treatment, but those who wish to practise it will find Hartewelt's Drop Injector (Fig. 30) a very manageable instrument. It is a hollow tube made of vulcanite, and suitably curved for introduction into the larynx. At the junction of the shank and the handle, on the upper part of the instrument, is a small cavity covered with a drum-like piece of caoutchouc and communicating with the interior of the tube. The injector is filled by pressing the air out of the cavity, and inserting the point of the instrument into the solution to be used. This instrument is made in two parts, so that the same handle can be employed with different tubes, and the points of the tubes are also made in different ways, some having a number of small holes, so that the stream is diffused: while

some have only a hole at one side, so that the fluid passes only in one direction, &c. &c. The injector is held between the thumb and second finger, and the index finger remains free to press on the elastic drum when the point of the instrument has been passed into the larynx. The late Dr. Gibb used a small syringe with a fine curved silver extremity, terminating

Fig. 30.—Hartewelt's Drop Injector.

in a small, finely perforated ball, by which showers of "the solution were distributed through the larynx." The principal objection to the use of injectors is that they have a tendency to cause more spasm than brushes, and with them it is more difficult to limit the amount of the application, or to confine it to certain spots.

Fig. 31.—Professor Siegle's Inhaler.

*Inhalers.*—For the application of liquids to the larynx in the form of a very fine spray many kinds of "atomizers"

have been invented; but Bergson's tubes have, in point of fact, superseded all others. These are applied in Dr. Andrew Clark's handball Spray-Producer, in which an india-rubber ball supplies air as the motive power, and in Professor Siegle's apparatus (Fig. 31), in which the atomization of the fluid is effected by steam; both are good instruments. The ordinary handball Spray-Producer is so well known that it does not require to be illustrated. Dr. Solis Cohen's Spray-Producer, in which only a single ball is used, is an extremely useful

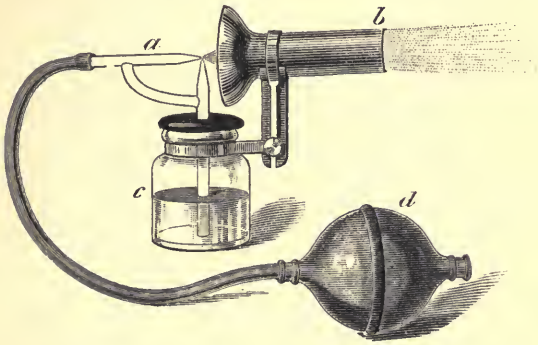


FIG. 32.—DR. SOLIS COHEN'S SINGLE-BALL ATOMIZER.

*a* glass points at right angles; *b* vulcanite tube for preventing dispersion of spray; *c* bottle containing medicated fluid; *d* india-rubber air ball.

instrument. There is no advantage in having a *continuous* spray for the throat, as the spray cannot be continuously inhaled. Indeed, it is more convenient to have the spray *interrupted*, as it can then be easily drawn in at each inspiration, and does not continue to flow during expiration and periods of rest. These instruments certainly produce a finer spray than those in which the fluid is pulverized by being projected in a fine jet against a disc or button; but they are open to the serious objection, that in all cases a very strong current of air or steam accompanies the atomized liquid. Where any dyspnœa exists, this is a very objectionable feature. The employment of atomizers in throat affections is more particularly indicated in cases where, from circumstances, the patient cannot visit his medical attendant sufficiently often, and is thus obliged to carry out the treatment himself. I do not recommend the use of these atomizers for the inhalation of caustic solutions.

For the inhalation of volatile medicaments, a supply of steam is all that is required, but the process can be best carried out with the aid of one of the numerous inhalers now in vogue. Those instruments are most effectual in which the patient inhales steam together with air, which is drawn through the hot liquid, and thus becomes thoroughly impregnated with the active principle of the medicament. In inhaling steam in which there is no such aërial current, the remedy acts much more feebly. The Eclectic Inhaler (Fig. 33) is

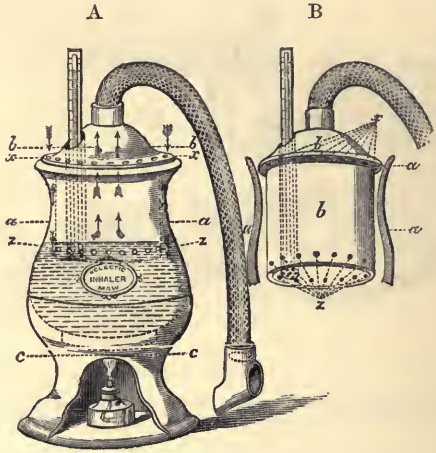


FIG. 33.—THE ECLECTIC INHALER.

The inhaler consists of three parts, *a*, *b*, and *c*. *a* is an open vase, and is essentially the containing vessel, into which the hot water and medicated solution are put. It is shown in A with a pint of water in it, and above the water-line is a large space for steam. *b* is a kind of lid resembling an inverted tumbler, which forms the cover of the containing vase. It is seen in its proper position in A, and with the sides of the vase drawn diagrammatically in B. The bottom of the tumbler forms the covering of the vase, and the sides of the tumbler dip down into it, leaving an air chamber between the two parts. When the vase contains the proper quantity of water, the sides of the inverted tumbler or lid dip down only about half-an-inch below the water-line. The circumference of the lid is perforated with small holes, as seen in *x*, and the circumference of what would be the rim of the tumbler is perforated in the same way at *z*. The apertures both above and below communicate with the air chamber. When the patient inhales, air rushes through the various holes above at *x*, then through the air chamber, again through the series of holes at *z*, and, finally, up to the mouth-piece, as shown by the course of the arrows. In the centre of the upper surface of the lid is a projecting nozzle, to which is attached a flexible tube, provided at its extremity with a double-valve earthenware mouth-piece. There is an opening in the lid, through which a thermometer, registering high temperatures, passes into the water. *c* is a stand on which the vase rests, and is made hollow, so as to hold a spirit lamp.

perhaps the most perfect of these instruments, but it is rather cumbersome.

Martindale's Portable Inhaler is an excellent apparatus, and fulfils most of the conditions of the Eclectic Inhaler, whilst it is much cheaper, and, being made of tin, is easily carried about without any risk of breaking.

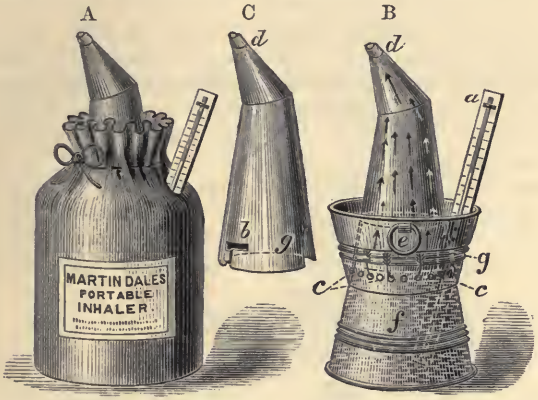


FIG. 34.—MARTINDALE'S PORTABLE INHALER.

A shows the inhaler ready for use, with a woollen covering, to prevent rapid cooling. B is the uncovered inhaler. C is its upper portion, which takes off for cleansing the apparatus, and to facilitate the packing.

FIG. 35.—BULLOCK'S HOSPITAL INHALER.

A shows the inhaler ready for use. B is the lid with nose-piece for nasal inhalations.

Bullock's Hospital Inhaler is cheap and serviceable.

It is made of stoneware, and has a tin lid and spout, the mouthpiece of which is covered with india-rubber.

Dr. Lee's Steam-draught Inhaler [1] is a very useful instrument, as it *delivers* the steam, and thus dispenses with the necessity for an inspiratory effort.

For the inhalation of burning substances, such as nitre, stramonium, arsenic, &c., no apparatus is absolutely necessary, as they can all be employed by merely being lighted on any non-inflammable substance. A special apparatus, however, such as the Fuming-Inhaler, is useful, particularly in employing nitre-papers.

*Steam Kettles* are useful in laryngitis and diphtheria. The best apparatus of this kind is the Ventilating Croup-Kettle, of Messrs. Allen (Fig. 37), which constantly delivers a small quantity of steam in a state of very fine subdivision.

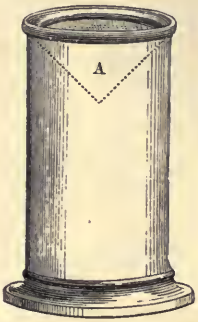


FIG. 36.—THE FUMING-INHALER.

This apparatus consists of a cylindrical earthenware vessel—a vase in fact—four inches high and two inches in diameter. An open wire diaphragm occupies the upper part of the cylinder.

*Insufflators.* — Powdered substances may be introduced into the larynx either by insufflation or by various kinds of injectors. This plan of treatment is of very ancient origin, having been introduced by Aretæus. The insufflators in use are (1) that of Rauchfuss (Fig. 38), in which the powder is expelled by pressure on an elastic ball at the end of the instrument; and (2) the Tube-Insufflator (Fig. 39). In this instrument a piece of elastic tubing is attached to the proximal extremity of the vulcanite tube. With the free end of the

[1] Manufactured by Messrs. S. Maw, Son, and Thompson.

tubing in his mouth, the operator blows the powder into the patient's larynx. This instrument is preferable to that of Rauchfuss, as the sudden pressure of the thumb on the ball of the latter instrument alters the direction of the

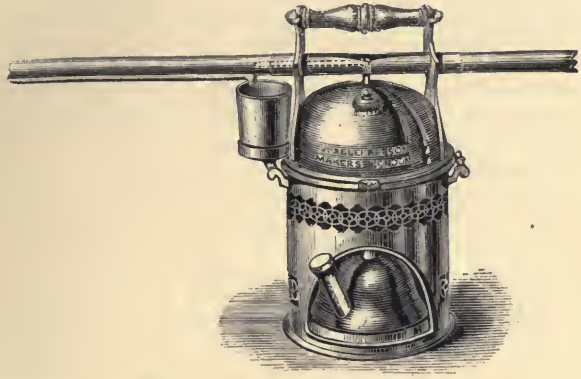

FIG. 37.—MESSRS. ALLEN'S VENTILATING CROUP-KETTLE.

FIG. 38.—DR. RAUCHFUSS' INJECTOR.

*a* a moveable tubular covering. *b* the cavity into which the powder is put.

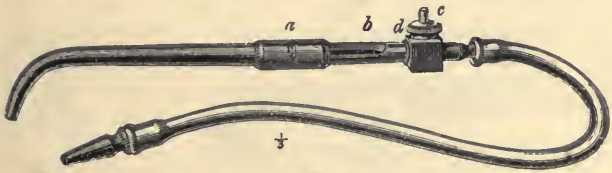


FIG. 39.—THE TUBE-INSUFFLATOR.

*a* a moveable tubular covering. *b* the cavity into which the powder is put. *c* stop, which closes the passage until it is pressed down. *d* valve which allows the air to pass towards the laryngeal extremity of the instrument, but prevents the patient expiring or coughing through the tube.

point of the injector, and thus renders the accurate application of the remedy very difficult.

*Porte-Caustiques.*—For applying solid nitrate of silver to

the larynx, the only instrument which is thoroughly safe, and at the same time easy to use, is the Laryngeal Cauterizer, first recommended by Lewin. It consists of a piece of aluminium wire, bent at the same angle, and of the same length above and below the angle as the laryngeal brush. The wire is roughened at its extremity and then dipped into some nitrate of silver fused over the spirit lamp. In this way a certain quantity of the nitrate adheres firmly to the wire. An ingenious *porte-caustique* has been invented by Dr. Fauvel, in which, whilst the stick of nitrate of silver is safely enclosed, the point, by a spiral spring behind it, is always kept protruding. Professor Stoerk, of Vienna, also, when laryngoscopy was quite in its infancy, contrived a porte-caustique in which the caustic remains concealed till brought to the part desired to be touched, when, by pressure on a spring in the handle, it is made to protrude. My laryngeal lancet is provided with a small piece of aluminium wire, which can be fitted on in place of the cutting blade; in this way it becomes a guarded porte-caustique. The nitrate of silver is attached to the wire by fusion in the way already described.

Besides these instruments, various others have been invented, but the simple aluminium wire answers the purpose perfectly well.

*Laryngeal Electrodes.*—These instruments are used daily by

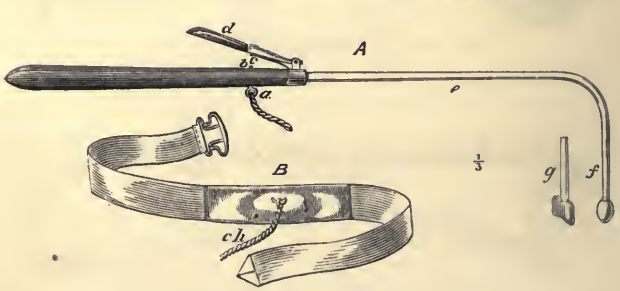


FIG. 40.—THE AUTHOR'S LARYNGEAL ELECTRODES AND NECKLET.

*A*, the laryngeal electrode; *a*, a metal ring by which the electrode is connected by a chain either with a battery or a magneto-electric machine; *b*, the extremity of a wire communicating with *a*; *c*, metal point, which, when the ivory handle, *d*, is pressed upon, touches *b*. The current then passes along the wire, *e* (which is insulated in caoutchouc), to the metal ball, *f*. This completes electrode No. 1. *g* represents the spade-shaped electrode for applying the current to the posterior crico-arytenoid muscles; the handle of the instrument is of wood or glass. *B* is the necklet which the patient wears. *ch* is the chain by which the necklet is connected with the apparatus producing the electricity.

nearly all laryngoscopists. They are so constructed that the current does not pass till the metal point or sponge is in contact with the vocal cords. The instrument is held in the hand between the thumb and second finger, and when the sponge has been placed in the desired position, the operator with his index finger presses on the key in the handle, and the electric current passes through the larynx to the skin externally. At the same time the patient wears a necklet communicating with the other wire of the battery.

In Dr. Fauvel's modification of my instrument (Fig. 41, A), the two poles are united in the same handle. The two rods are carefully isolated, and only when the little key on the upper part of the instrument is touched does the current pass between the two brass knobs. In a third instrument here shown (Fig. 41, B), the electrodes are more widely separated, so that they can straddle across the ary-epiglottic fold, and embrace the lateral-crico-arytenoid muscle. This arrangement is useful for limiting the electric current to the thyro-arytenoideus muscle.

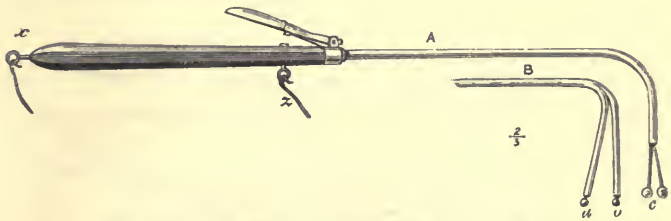


FIG. 41.—LARYNGEAL ELECTRODES NOS. 2 AND 3.

A represents Dr. Fauvel's modification of my instrument, which is called No. 2 electrode. The current passes between the two knobs at *c*. B represents the adductor, or No. 3 electrode. It is introduced into the larynx in such a way that the pole, *o*, is in contact with the vocal cord, and *u* passes into the hyoid fossa. In this way the lateral crico-arytenoid is embraced between the two poles. The extremity of the hyoid electrode should be about five-eighths of an inch distant from, and slightly posterior to, the pole which is applied to the vocal cord.

*Laryngeal lancets* are of various kinds. My own instrument consists of a small double-edged knife or lancet, which is contained in a hollow tube, suitably curved for introduction into the larynx. The point of the lancet is concealed in the duck-billed extremity of the tube till forced out by pressure on a spring in the handle. The stock of the instrument is provided with tubes bent at different angles, and below the angle is a joint which enables the operator to lengthen or shorten the tube. This arrange-

ment allows for the varying inclination which the plane of the laryngeal aperture bears to the horizon, and renders the lancet fit for operating either at the upper or lower part of

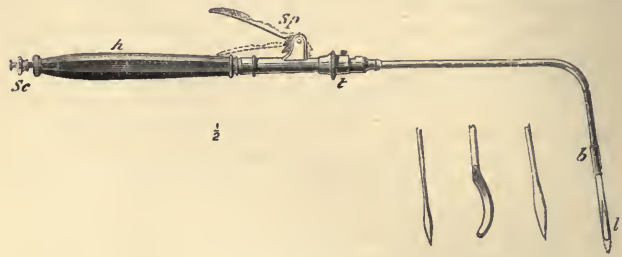


FIG. 42.—THE GUARDED LARYNGEAL LANCET AND VARIOUS KNIVES.

*Sp*, the spring which forces out the lancet; when it is pressed down to the dotted line, the lancet, *l*, protrudes. *h*, the handle. *Sc*, the screws, by turning which the length of the point of the lancet can be regulated. *t*, junction of the barrel and stock of the instrument. At this point, barrels curved at different angles can be applied. *b*, the bayonet joint. A shorter or longer tube can be put on here, according to circumstances, and the blade can be taken out and cleaned. The engraving also shows the various blades recommended by Tobold.

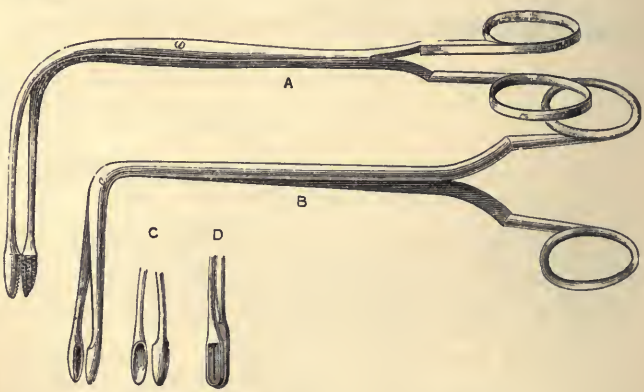


FIG. 43.—THE AUTHOR'S CUTTING-FORCEPS.

A, the lateral forceps. B, the antero-posterior forceps. C, spoon-shaped forceps. D, punch-forceps.

the larynx. The length of the blade is regulated by a screw in the handle. The instrument is held between the thumb and second finger, and when its extremity is brought opposite the part which the operator wishes to lance, he presses on

the spring in the handle with his index finger. Dr. Tobold's unguarded knives give more power to the operator than can be obtained with the moveable concealed blades of my protected Laryngeal Lancet, but their use should be confined to

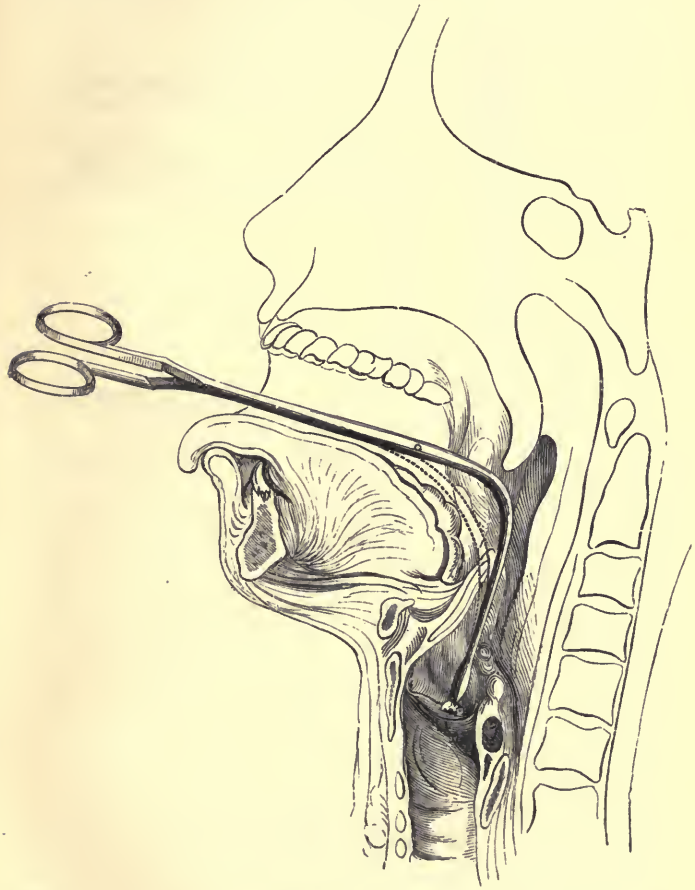

FIG. 44.—THE AUTHOR'S COMMON LATERAL FORCEPS, SHOWN *in situ*.

the hands of those thoroughly skilled in the use of laryngoscopic instruments.

*The common laryngeal forceps* are made of different

lengths and curved at different angles. Some open like ordinary forceps, laterally (Fig. 43, A), whilst others open backwards and forwards (Fig. 43, B). The instrument is shown *in situ* in Fig. 44. I now scarcely ever use any other instrument than these forceps for removing laryngeal growths. Larger experience has also convinced me that forceps should not be

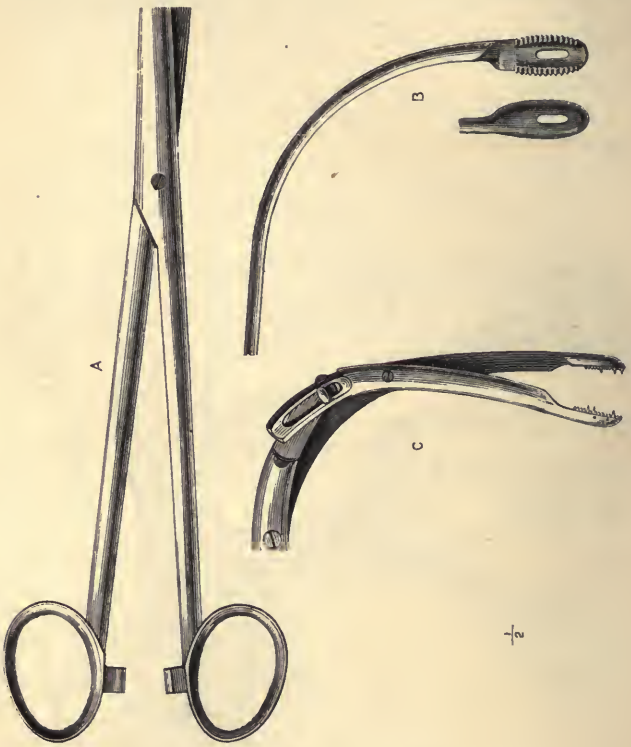


FIG. 45.—DR. FAUVEL'S FORCEPS.

A, the handle of the instrument, showing the arrangement for locking the blade. B, the lateral blades. C, the antero-posterior blades, showing the manner in which one blade plays in a slot.

slender, but, on the other hand, rather stout. There is too much vibration and too little firmness in the slender instruments, and though they look much more suitable for delicate operations, carried out with the laryngeal mirror, they are in

point of fact less serviceable. Dr. Fauvel, who has been so remarkably successful in the removal of growths from the larynx, uses even stronger and larger forceps than myself. In order to grasp the growth more firmly he also has a catch fixed to the rings of the handles, so that, when desired, the blades can be made to lock.

*The tube forceps* consist of a steel tube of a diameter of one-tenth of an inch, containing the forceps. It is bent at an

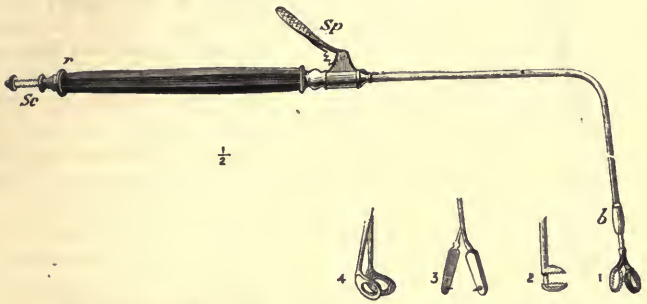


FIG. 46.—THE AUTHOR'S TUBE-FORCEPS AND SCISSORS.

*Sp*, the spring, by pressing on which the tube is forced over the base of the forceps. *b*, the joint at which longer or shorter tubes may be applied, and the blades taken out and cleaned. (This joint has been made unnecessarily large by the draughtsman.) *r*, the ring, by turning which the forceps revolve so that the blades open in any direction. *Sc*, the screw for taking the instrument to pieces, cleaning it, &c. 1, the perpendicular blades. 2 and 4, horizontal blades. 3, the scissors, with hooks attached to them.

angle of 90°, but to the same stock barrels of different angles can be applied. Just below the angle is a joint which enables the practitioner to clean the forceps and apply shorter or longer blades, as the case may require. The spring which forces the tube over the forceps is at the anterior and upper part of the handle; and the operator, holding the instrument between his thumb and second finger, presses on the spring with his index finger. At the posterior part of the handle is a ring, by which the forceps can be made to revolve, and in this way the blades can be made to open backwards and forwards, or from side to side. This arrangement enables the operator to seize excrescences, whether they grow from near the anterior insertion of the vocal cords, from the arytenoid cartilages, or from either side of the larynx. The blades of the forceps have sharp-cutting teeth all round their edges. For most cases, the blades which pass down perpendicularly from within the tube containing them are convenient; but

sometimes where the growths are thin and membranous, and have an extensive origin from the side of the larynx, forceps, with blades opening horizontally, will be found more suitable. In this case the forceps have in fact only one moveable blade, which is at right angles to the shank, the other blade being let into the tube: the two blades of the forceps close when the tube containing the upper blade is forced down by the pressure of the index finger on the spring in the handle.

FIG. 47.—PROFESSOR SCHROETTER'S FORCEPS.

At the joint below the angle of the instrument scissors can be fitted instead of the forceps. In order that the blades should readily cut, the shanks of the scissors should cross one another above the blades; the scissors have hooks on each blade, which seize the divided particles and prevent their falling into the trachea.

Schroetter's *laryngeal forceps* are of the tube character, but the handle is placed at an oblique angle to the shank, so that the operator's hand is kept to one side, altogether out of the field of vision. The upper blade is fixed, being in fact part of the tube, whilst the lower blade is attached at right angles to a solid wire which moves within the tube. In order to reach growths in different parts of the larynx, several tubes

are required for the same handle, as the forceps have only one movement (viz., the upward movement of the lower

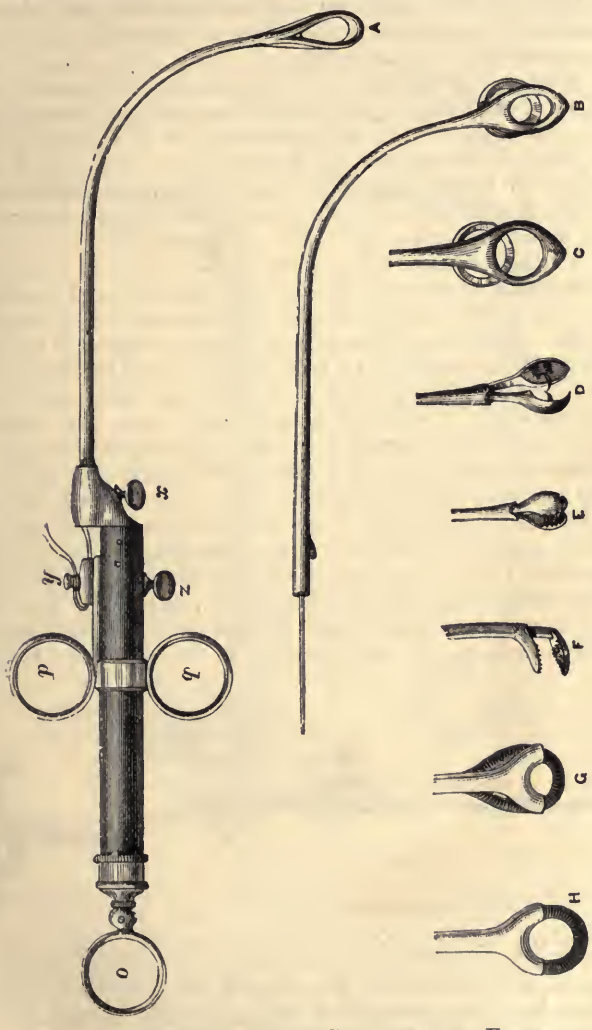


FIG. 48.—PROFESSOR STOERK'S GUILLOTINE AND FORCEPS.

A, wire écraseur. B, guillotine. C, ditto (larger). D, E, and F, forceps. G and H, improved guillotine, avoiding the loss of space in B and C. H shows the guillotine open. G, the same instrument half closed.

blade), which is brought about by touching a slide in the handle of the instrument with the thumb. These forceps are only adapted for removing very small growths, but they are particularly convenient for effecting evulsion at the anterior commissure of the vocal cords.

*Écraseurs* of different construction have been used for the removal of laryngeal growths with more or less success since the invention of the laryngoscope. In this country Drs. Walker, Gibb, and George Johnson have employed them; whilst in France an *écraseur*, combined with a kind of dart, which is said to transfix the growth, has been recommended by Moura-Borouillou.

To these instruments I always entertained the objection, that the wire was very likely to be displaced, and that the growth could only be accidentally ensnared after repeated trials. This inconvenience was, however, overcome by Professor Stoerk, who had an *écraseur* constructed in such a way that the wire is concealed in a solid loop of metal. This prevents the wire being pushed aside when the operator proceeds to put it over the growth. The instrument is thus rendered much more serviceable, but it really acts more on the principle of a *guillotine* than an *écraseur*, and, indeed, Professor Stoerk employs the same handle with a circular knife instead of the wire. For operating on very large growths I have, however, used a modification of Stoerk's instruments, in which, by means of a cog-wheel, that can be turned by the index finger, the wire slowly crushes through the growth on the true principle of the *écraseur*. I have

Fig. 49.—The Author's Guarded-Wheel Ecraseur.

called this instrument the guarded-wheel *écraseur*. Two cases in which it had been employed were brought by me before the Pathological Society[1] some years ago.

[1] "Trans. Path. Soc.," pp. 52 and 53 (1870).

## DILATORS OF THE LARYNX.

For dilating the larynx when it has become blocked up by organized membrane or by cicatricial tissue, various dilators have been invented. In most cases the use of these instruments is facilitated by the previous performance of tracheotomy, which is almost certain to have become necessary.

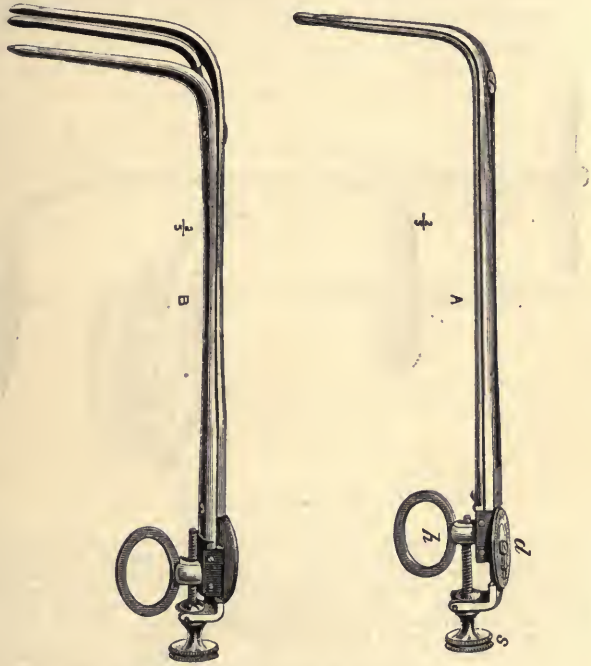


FIG. 50.—THE AUTHOR'S DILATOR.

A, the instrument closed; by turning the screw, *s*, the blades separate, whilst the dial, *d*, shows the extent to which the dilatation has taken place.

*The screw dilator* is an instrument which I have occasionally used for the last fourteen years. It consists of three blades which, when united together, form a solid instrument easily introduced into the larynx. When the instrument has been passed into the constricted larynx, a screw at its proximal extremity enables the operator to open the blades

and thus effect distension, the degree of which is shown on a dial placed near the screw.

Professor Navratil, of Pesth, has invented an instrument very much on the principle of my dilator, but much more perfect in its details, and consisting of four segments instead of three; moreover the dilating action in his instrument is confined to its laryngeal portion, whilst in mine it extends a little above its angle. The only objection to Professor Navratil's instrument is its extremely complicated construction, which renders it liable to get out of order and difficult to clean.

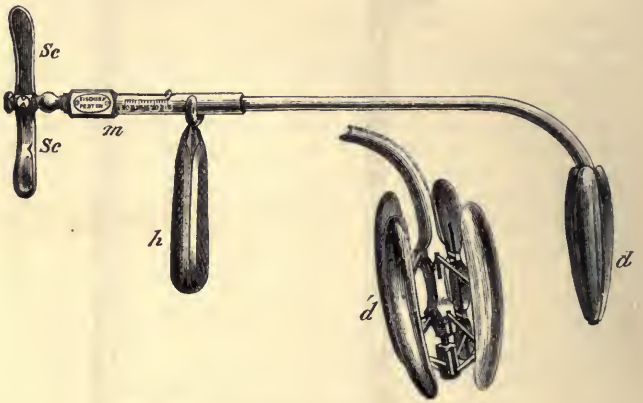


FIG. 51.—PROFESSOR NAVRATIL'S DILATOR.

This instrument consists of a silver tube containing a steel rod, terminating at the distal extremity in an olive-shaped body, rather pointed below and broad above, the dilator proper (*d* and *'d*), and at the proximal end in a screw (*Sc*); between the two is a handle (*h*), which the patient holds after the introduction of the instrument into the mouth. The olive-shaped dilator varies in length from 4½ to 6 centimetres, and its diameter is from 12 millimetres to 8 millimetres above, and from 5 millimetres to 2 millimetres below. The olivary body (*d* and *'d*) consists of four segments, each segment having three joints; the segments can be made to extend symmetrically to a distance of from 20 to 30 millimetres by turning the screw, and a measure on the instrument, between the handle and its proximal extremity, indicates the amount of dilatation that has taken place.

*Dilating tubes* were first introduced by Professor Schroetter, and the profession is greatly indebted to that physician for developing the treatment of a very difficult class of cases. Professor Schroetter originally employed hollow curved tubes of vulcanite of various sizes. Small tubes are first used, and subsequently when the larynx is more dilated, larger tubes can be employed. The fact that these tubes (although hollow and

thus permitting the patient to breathe) cannot be tolerated for more than a few seconds on account of the pharyngeal irritation and retching which they produce, led Professor Schroetter to invent the instrument now to be described.

*The Laryngeal Dilating-Plug.*—This instrument consists of a leaden plug, which is temporarily attached to a suitably curved hollow tube by means of twine passing through the tube. It can only be used when tracheotomy has been previously performed, and a canula is worn with an opening in its upper surface. The plug is introduced into the larynx, and its lower end, which is perforated by an oblique passage, passes into the tracheal canula. It is retained in this position by a bolt, which takes the place of the ordinary inner tube of the canula. When the plug is thus fixed in position the laryngeal tube is withdrawn, whilst the twine which is left protruding from the mouth can be tied round the neck or behind one ear. When it is desired to withdraw the instrument the bolt is removed from the canula and

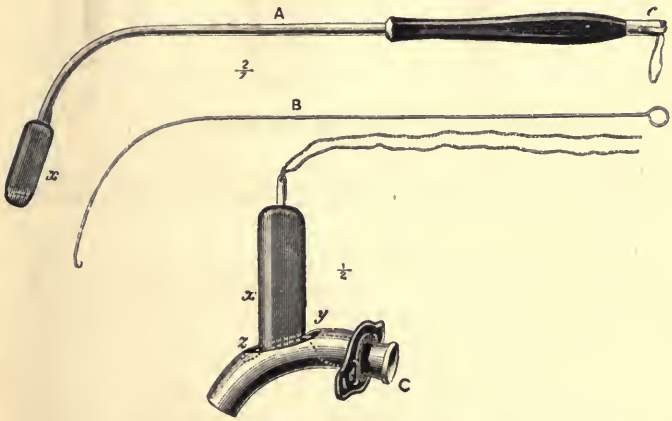


FIG. 52.—PROFESSOR SCHROETTER'S DILATOR.

A. The instrument ready for use. It is a hollow, curved tube, fitting into a perforated handle, and terminating in a metal plug (*x*). The latter is kept attached to the tube by a piece of twine, which passes through the tubular instrument, and is fixed to the proximal extremity of the handle by a clip. The metal plug has a ring at its upper part and a small canal (*y*) passing obliquely through its lower extremity. B is a fine silver rod, by means of which the twine is drawn through the tube when it is being prepared for use. C corresponds to the inner tube of a tracheotomy canula, which, instead of being continued as a tube, terminates in a bar (*z*), passes through the plug when *in situ* (*i.e.*, in the contracted larynx) and bolts it in position.

the plug is drawn up from the larynx by means of the twine. It may be allowed to remain in the larynx for an hour or half an hour the first time, but this period may be gradually increased until the patient retains it for the whole day.

*The Cutting-Dilator.*—Dr. Whistler has invented a very ingenious cutting-dilator, which is particularly serviceable for dividing webs or membranous formations.

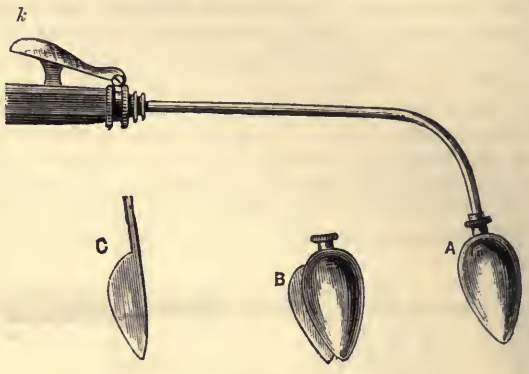


FIG. 53.—DR. WHISTLER'S CUTTING-DILATOR.

A is the olivary extremity of the instrument, with the blade concealed; B shows the blade projecting from its sheath, when the key (*k*) is pressed upon; and C, the blade altogether removed from its covering.

This instrument consists of a pointed, olive-shaped body, placed at the end of a suitably-curved shank, and containing within its interior a sharp blade, which can be made to protrude by touching a little key in the upper part of the handle. When the instrument is passed into the larynx, any existing web is put upon the stretch, and thus rendered tense for division. The knife is so arranged that it can be made to cut forwards towards the anterior commissure or backwards towards the inter-arytenoid fold, according to the situation of the strictnre.

## ACUTE CATARRHAL LARYNGITIS.

(Synonyms: Spurious Croup. Acute Catarrh of the Larynx. Acute Laryngitis.)

*Latin Eq.*—Laryngitis acuta catarrhalis.
*French Eq.*—Laryngite catarrhale.
*German Eq.*—Akuter kehlkopfkatarrh.
*Italian Eq.*—Catarro acuto della laringe.

(*See* also Œdematous Laryngitis.)

Definition.—*Acute catarrhal inflammation of the mucous membrane of the larynx, seldom dangerous to life, giving rise to hoarseness or aphonia, and sometimes to slight dyspnœa and stridulous breathing in children, in whom, however, it almost invariably ends in resolution. In adults, it often passes into the chronic form of inflammation, and in very rare cases may result in œdema.*

*History.*—This disease was partially described by Millar,[1] more than 100 years ago, but that observer gave an obscure picture of the affection from mixing up catarrhal laryngitis with spasm of the glottis. Hence he was led to regard the complaint as a neurosis, and to recommend anti-spasmodic remedies. Guersant[2] first gave a clear account of the pathology of the disease, and employed the terms "*faux croup*" and "*laryngite striduleuse.*"

*Etiology.*—The causes which provoke acute catarrhal inflammation of the larynx are such as favour analogous affections of mucous membranes generally, amongst which, in so-called temperate climates, "catching cold" is the most common. Cold draughts of air, whether inspired directly, or bearing on the neck and ears externally, are particularly liable to give rise to laryngeal catarrh. Exposure of the body in general to cold, and especially allowing the feet to remain wet and cold for any length of time, are also common causes of an attack. As Krieger[3] well points out, children whose vital power has been lowered by prolonged confinement to the house in bad weather often catch cold in their first walk through dusty streets on a windy day. But frequently the cause of laryngeal catarrh is of a more local nature. Thus

[1] "Observations on Asthma and Hooping Cough." London, 1769.
[2] "Revue Médicale," Octobre, 1829.
[3] "Aetiologische Studien." Strassburg, 1877. Cited by Rauchfuss: Loc. cit.

violent functional efforts (as in giving the word of command, preaching, singing, &c.), as well as straining the parts in coughing, are not uncommon causes of it. Hot alcoholic drinks, excessive tobacco smoking, dusty air, irritating vapours, foreign bodies accidentally entering the larynx, may also be enumerated as frequent excitants of the disease. Or it may be propagated from the nares and pharynx, the more severe forms of inflammation of the latter region being especially prone to spread to the neighbouring region of the larynx. Extension of the disease occasionally takes place from below, the bronchial tubes being first affected; but the opposite sequence is more usual, the laryngeal inflammation passing off with the occurrence of bronchitis. Relaxing habits and indoor occupations undoubtedly predispose to the disease. At the Hospital for Diseases of the Throat, catarrh of the larynx is much more often met with among tailors, shoemakers, house-porters, and people thus engaged, than among coachmen, cab-drivers, policemen, and others who are constantly exposed to the most inclement weather. Previous attacks, especially if several times repeated, increase the susceptibility of the individual to a renewal of the affection. Males are more liable to it than females, and adults than children, but in young subjects the disease gives rise to much more marked symptoms, and hence attracts more attention. Laryngeal catarrh is also a very usual accompaniment of hay asthma, and is often met with in the exanthemata, especially in measles.

*Symptoms.*—The patient complains at first of slight dryness or soreness of the throat, with hoarseness, and a disposition to cough. This sensation varies from a mere feeling of tickling or roughness, to a sense of constriction about the throat, with slight odynphagia. It rarely happens that manipulation of the organ from without causes pain, but great uneasiness is sometimes experienced on attempted phonation. The voice is usually at first hoarse or defective in timbre, but afterwards it may be extinguished. The cough may be altogether absent, but it is generally rather shrill, and in severe cases may be aphonic. The respiration is not affected as a rule, but, as will be presently shown, it is sometimes embarrassed in children, the narrow area of the glottis, in young subjects, easily resulting in some stenosis, and a corresponding difficulty of breathing. In the adult, on the other hand, considerable swelling may ensue, without curtailing the breathing space. The inspiration is, however,

generally a little prolonged and occasionally associated with stridor, and mucous râles can usually be heard on auscultating the larynx. Slight mucous expectoration accompanies these symptoms, but if the secretion becomes thick, purulent, and abundant, it may be regarded as coming from the bronchial tubes.

In children there is sometimes marked fever, the tongue is white and furred, with red tip and edges, the pulse frequent and hard, the skin hot, and the face flushed. In these young subjects suffocative attacks, occurring during sleep, are an important feature of the disease. This symptom has given rise to considerable confusion, both in theory and practice, as well as to much warm debate in medical circles. It generally occurs in children who, without constitutional disturbance, have manifested during the daytime some degree of hoarseness and cough, but to such a slight extent as not to excite any apprehension. At night the scene is suddenly changed. The child who has been sleeping some hours wakes up in terror, its breathing is laboured, inspiration prolonged and noisy, voice and cough husky, features congested, and its whole aspect one of impending suffocation. In the general alarm the little patient is apt to be drugged and nauseated, proceedings which a knowledge of the actual state of things will show to be for the most part unwarranted. This form of the disease has been called *laryngitis stridulosa*, and it has been generally thought to be due to spasmodic action of the adductors of the vocal cords. It is probable that muscular action operates as a secondary cause, but that it depends primarily on the laryngeal secretion becoming inspissated during sleep. when the mouth is often open. Collecting in this state in the very narrow glottis of the child, and adhering to the vocal cords, the thickened mucus gives rise to a gradually increasing impediment to respiration, till the terrified little patient awakes in a storm of anguish. Between crying, coughing, and vomiting the difficulty is got over, and the child shortly falls asleep, to repeat, it may be in a few hours, a scene which to the uninitiated presents all the features of impending death.

*The laryngoscopic appearances* vary with the degree of severity of the attack, as well as with the stage at which the inspection is made. In mild cases, and at an early period, the whole of the mucous membrane is of a bright red colour, though the hyperæmia may be confined to certain

parts, such as the posterior extremities of the vocal cords, the inter-arytenoid fold, or the ventricular bands. Sometimes there is distinct injection of the vessels, but usually the congestion is general. Occasionally hæmorrhage takes place either into the tissues or from the mucous surface. The latter variety has been called *laryngitis hæmorrhagica*, but it is scarcely necessary to give a special name to so rare and accidental a condition. I have met with a few cases, and examples have been recorded by Navratil[1] and Fränkel.[2] In these, as well as in nearly all the other recorded cases, the congestion was *slight*, and the hæmorrhage almost always resulted from some violent expiratory effort, such as coughing or vomiting. In more severe forms the mucous membrane is swollen, as well as red; and when, as frequently happens, the ventricular bands are affected, the turgid state of these folds causes them to overlap the vocal cords, so that the latter are entirely concealed, or seen only as slender threads of a reddish tint. When the ary-epiglottic folds are attacked they generally maintain their normal shape; and, in these cases, the epiglottis is seldom inflamed to such an extent as to block out the view of the larynx. Small patches of shallow ulceration, or erosions, which amount to little more than a desquamation of the epithelial layer of the mucous membrane, and leave no cicatrices on healing, are not unfrequently to be seen. They constitute the *érosions glandulaires* of French authors, according to whom they arise from suppuration in the follicles of the larynx. The point at which the pus escapes becomes a minute ulcer, which heals rapidly.[3]

Various modifications of the mechanism of the larynx, to which the objective phenomena already described are due, may also be observed. Thus the changes in vocalization, noticed at the very commencement of the attack, may be seen, in some cases, to depend upon a protrusion of the swollen inter-arytenoid fold between the vocal cords; or on a similar obstacle at the anterior commissure. Both these conditions are, however, as Ziemssen[4] remarks, comparatively rare. It is more frequent when the patient attempts to vocalize to find a defect in the parallelism of the cords, their free margins presenting a concave outline, and forming an open glottis inconsistent with

[1] "Laryngol. Beiträge." Leipzig, p. 18.
[2] "Berlin. Klin. Wochenschrift." 1874, No. 2.
[3] Krishaber: "Dict. des Sciences Méd." art. "Larynx." Paris, 1868.
[4] "Cyclopædia of Med." vol. iv.

perfect phonation. This condition, as Gerhardt[1] points out, is often caused by palsy or paresis of the thyro-arytenoid muscles, and indicating, as it does, an early change in the nerve supply of the intrinsic muscles, has a deep physiological import. Although the elementary character of this treatise prohibits the discussion of this suggestive topic, it may be remarked that the derangement of motor function often precedes the superficial hyperæmia, which from being a more striking feature is apt to be regarded as the earliest expression of the inflammatory state. The alteration of the voice thus early brought about points unmistakably to an interference with the innervation of the region as the initial step in some cases of inflammation. But whatever hypothesis is ultimately adopted to explain the phenomena in question, the fact that "the longitudinal, and perhaps also the transverse tension of the vocal cords is incomplete, and probably also unequal," is regarded by Ziemssen, with whose opinion I entirely agree, as a probable explanation of the "huskiness, jarring, and shrillness of the voice," which characterize the early stages of the disease.

In very severe cases *œdema* may occur, and rapidly give rise to a serious stenosis. This condition will be referred to under "œdematous laryngitis;" but it may be here remarked that acute catarrh of the larynx is, in the majority of instances, a superficial and transient affection, which under suitable treatment generally ends favourably in the course of a few days. If neglected, however, it is likely to pass into chronic laryngitis, and is occasionally the starting point in the formation of papillary growths and other neoplasms from the mucous tissue.

*Pathology.*—Catarrhal inflammation of the larynx consists in a hyperæmia of the vessels of the mucous membrane. It may be either active (*i.e.* fluxionary) or passive. In effect it causes a reddening of the mucous membrane, together with an increased succulence of the epithelial layers, and a corresponding excess of secretion, consisting for the most part of a watery fluid containing imperfectly developed epithelial cells. The vascular turgescence increases the lateral pressure on the walls of the vessels, and causes changes in their intimate structure. At first only the plasma of the blood exudes, but soon an emigration of colourless corpuscles takes place. In

[1] "Handbuch der Kinderkrankheiten." Tübingen, 1878, 3ter Band, 2te Hfte., p. 322.

[2] Op. cit.

inflammation of moderate severity, these migratory cells disappear with the hyperæmia, but when the inflammatory process is more persistent they become organized and converted into lymphoid tissue. These lymphoid degenerations will be again referred to under the head of "Chronic Laryngitis." Sometimes, beyond a sodden condition of the mucous membrane, there are no pathological phenomena. If the patient die from other cause, on post-mortem examination the hyperæmia is frequently not discoverable, and this is often the case when the congestion during life has assumed very considerable proportions. The probable explanation of this anomaly is to be found in the rich endowment of the mucous membrane of the larynx with elastic fibres, the contraction of which *in articulo mortis* removes the engorgement of the capillaries by pressing out their contents.

*Diagnosis.*—A due consideration of the foregoing conditions, both objective and subjective, should leave little room for doubt as to the nature of the affection, except perhaps in the case of very young children. In catarrh the symptoms, though they may remit, do not pass off so completely as in laryngismus. In diphtheritic inflammation, *i.e.*, true croup, the symptoms are much more severe, and there is often the presence of false membrane in the pharynx. In the absence of the latter phenomenon, the absolute necessity for confirming the diagnosis by laryngoscopic inspection, where it can be accomplished, is evident. The possibility of a foreign body having entered the air passages must not be forgotten.

*Prognosis.*—This is always most favourable. Mild cases of catarrh pass off in a few days almost without treatment, and those of more severe character usually quickly yield to suitable remedies.

*Treatment.*—*In the case of adults*, the patient should be kept in a uniformly warm atmosphere, should employ warm and soothing inhalations, such as the benzoin, hemlock, or hop inhalations of the Throat Hospital Pharmacopœia, and should *abstain altogether from using the voice*, and from taking food or drink of an irritating character. A compress to the neck often arrests an impending attack, or cuts short the disease at its inception. Diaphoretics may be administered when there is any fever, and a purge is often useful at the outset. If there is any disposition to cough, the patient should be kept slightly under the influence of opium. The drinking of warm milk mixed with an equal quantity of

alkaline mineral water, as soda or seltzer water, is much praised by German authors. Though empirical in origin, like the proceeding sanctioned by Niemeyer of allowing the patient to eat very salt herrings, there can be no doubt that carbonate of soda and common salt exercise a solvent effect upon mucous accumulations, and it is doubtless from this cause that relief attends their administration. In those rare cases in which there is hæmorrhage from the larynx, a strong astringent, such as tannic acid (ʒij. ad ℥j.) should be applied to the bleeding spot. In a case of this kind Dr. Smyly, of Dublin, on one occasion immediately arrested the hæmorrhage by the application of Ruspini's Styptic. When the disease begins to pass off astringent solutions such as the zinc and iron "pigments" of the Throat Hospital Pharmacopœia are often very serviceable.

*In the case of children*, a moist atmosphere maintained by the generation of steam is always advantageous. By this means the drying of the secretion during sleep is averted, and the alarming attacks of dyspnœa, due to this cause, are warded off. As in the case of adults, a warm compress to the throat often acts very favourably, and a hot sponge over the sternum is a time-honoured remedy in these cases. As young children can seldom use any apparatus which requires any effort in inspiration, the warm soothing inhalations already mentioned should be employed by means of the croup-tent (see page 167) and the "ventilating croup-kettle," or with the aid of some other similar arrangements. Opiates are sometimes required, and their tendency "to dry up the mucus" is best obviated by administering the remedy in the form of the compound tincture of camphor, and by combining it with squills. At the same time non-depressant emetics, such as sulphate of zinc (grs. xv. to grs. xx.), or sulphate of copper (grs. v. to grs. vii.), in plenty of warm water, may occasionally be required. In catarrhal inflammation of the larynx I do not recommend the application of remedies with the brush, but Gibb,[1] acting on the suggestion of Horace Green, employed solutions of nitrate of silver (grs. xl. ad ℥j.), and stated that according to his experience one or at most two applications of this salt usually suffice to subdue the local inflammation. This treatment has been recommended by other English practitioners, and lately also by Professor

[1] "Diseases of the Throat." 2nd edit. p. 197.

Stoerk.[1] In my own practice, however, the results following the topical application of this salt have not been satisfactory, and I have seen the whole train of symptoms greatly aggravated by its use. Stoerk[2] further recommends that catarrhal laryngitis should be treated by the internal and external use of ice. Leeching, bleeding, blisters, mercury and antimony, the sheet-anchors of our predecessors, are remedies quite out of date in the treatment of the disease, and cannot be put in the balance against our modern methods.

*Prophylaxis.*—In the case of children who possess a specially vulnerable mucous membrane, such as may be inherited from phthisical parents, certain *precautionary measures* should be adopted to diminish the susceptibility to catarrh. The best of these, perhaps, consists of tepid sponging with salt water on rising in the morning, followed by friction to the entire body. Judicious clothing, especially the wearing of flannel next the skin, should be enforced, and the adoption of regular out-door exercise insisted on. Great care should be taken to avoid over-heated sitting-rooms or bedrooms. At suitable seasons a residence at the seaside, for the purpose of sea-bathing, will generally prove beneficial. In the case of children and old people, the mineral waters of Royat, taken in July and August, greatly diminish the catarrhal tendency in the succeeding winters; whilst for adults, the waters of Mont Dore have a similarly favourable influence.

## ŒDEMATOUS LARYNGITIS.

(Synonyms: Laryngitis Phlegmonosa. Laryngitis Submucosa Purulenta.)

*Latin Eq.*—Œdema acuta laryngis vel glottidis. Laryngitis phlegmonosa.

*French Eq.*—Laryngite œdémateuse. Œdème aigu de la glotte.

*German Eq.*—Phlegmonöse Kehlkopfentzündung. Oedem der Glottis. Glottisödem.

*Italian Eq.*—Laringitide edematosa. Edema acuto della laringe.

[1] "Klinik der Krankheiten des Kehlkopfes." Stuttgart, Enke, 1876.

[2] Ibid.

DEFINITION.—*Acute infiltration of the areolar tissue of the larynx by a serous, sero-purulent, or purulent fluid, characterized in severe cases by orthopnœa, stridulous breathing and dysphonia or aphonia.*

*History.*—The descriptions of ancient authors, founded as they are entirely on the symptoms observed during life, and expressed in terms usually vague and often confused, do not point to this disease with any degree of certainty. The observations of Hippocrates,[1] Aretæus,[2] and Celsus[3] are equally applicable to laryngeal diphtheria, whilst those of Cælius Aurelianus[4] and Ætius[5] specially point to the plastic form of inflammation. In 1765 Morgagni[6] first gave a correct account of the conditions founded on post-mortem examination, and subsequently Boerhaave[7] and Van Swieten[8] accurately described the œdematous character of the inflammation. These latter physicians did not, however, distinguish clearly between pharyngitis and laryngitis. Gradually medical writers became quite familiar with the malady, and in 1801 Bichat[9] described it with considerable detail, although since he speaks of it as "a particular kind of serous swelling which does not occur in any other situation," it is evident that he did not understand its pathological relations. In 1815 the various phenomena of œdema of the larynx were first scientifically portrayed by Bayle,[10] and from his writings we may date the commencement of the literature of the subject. Previous to 1852 numerous papers of more or less importance had appeared in medical journals, especially in France, but it was reserved for Sestier[11] in that year to collect these and found upon them a standard treatise containing a vast amount of statistical evidence.

*Etiology.*—The origin of the disease has been so minutely investigated by Sestier that it is impossible to do justice to the subject without largely making use of his laborious researches, which have reference to no less than 245 cases,[12]

[1] "Prædict." l. iii.
[2] L. l. cap. vi.
[3] L. iv. cap. iv.
[4] L. iii. cap. ii.
[5] "Βιβλία Ἰατρικὰ." l. v. c. 21.
[6] "De Sed. et Caus. Morb."
[7] "Aphorismi de Cognoscendis," &c. 801, 802.
[8] "Comment. in Boerhaave."
[9] "Anat. descript." t. ii. p. 399.
[10] "Dict. des Sc. Méd." t. xviii. p. 505.
[11] "Traité de l'angine laryngée œdémateuse." Paris, 1852.
[12] In some of these cases the ultimate issue was not stated, and in others, the age or sex was not given. This explains how it is that the number of cases used in the text for statistical purposes in relation to these matters, varies in different instances.

exclusive of cases of scald-throat. It must not be forgotten, however, that certain fallacies are present in his statistics, which cannot therefore be taken as an unerring guide in considering the etiology of this disease. For the chronic and acute forms of œdema are not separated, and many cases where a deposit of a dense character was present are included as œdema. His statistics, however, must always have considerable value.

The influence of age and sex is marked. The affection is rare before eighteen years of age, but prevails from that time to fifty, its maximum being between eighteen and thirty-five. In 215 cases, Sestier found five children under five years—one a new-born infant—and twelve cases between five and fifteen years. As regards sex, the same author noted, in 187 adults, 131 men and 56 women.

Acute œdematous laryngitis may be either *primary* or *secondary*, that is to say, it may either attack healthy persons, or may affect those previously suffering from some other complaint. In 190 cases Sestier found 36 primary and 122 secondary. The affection is called *typical* where it originates in the larynx, *contiguous* where it spreads from the pharynx or other parts, and *consecutive* where it occurs as a sequel to disease of the cartilages, or other structures of the larynx.

*Typical œdematous laryngitis* is extremely rare. The statistics of Sestier demonstrate, and it has already been shown in the last article, that catarrhal laryngitis is usually a mild affection of the mucous membrane, in which the submucous areolar tissue is very little concerned. According to Sestier simple inflammation was the cause of œdema in rather more than 6 per cent. of all his cases. I believe that in nearly all these instances of so-called "simple inflammation" the disease is due to blood-poisoning. I have met with the affection amongst hospital physicians, medical students, and nurses, and in cases where defective drainage seemed to be its cause. I may add that in every case that has come under my notice, ample opportunity of acquiring septicæmia has been present. Sestier's statistics in relation to this form of œdema bring out prominently another fact, viz., that acute œdematous inflammation is a very rare malady amongst children. Thus out of the 245 cases only twice did the disease occur as a primary affection in a child. In the fifteen examples of simple œdematous inflammation occurring amongst adults fourteen were men, and only one a woman.

*Contiguous œdematous laryngitis*, though rare in itself, is the most common form of the disease. Propagation most frequently takes place from the pharynx, and was found in more than 20 per cent. of Sestier's cases. Out of fifty-six instances where the disease originated in simple inflammation of the pharynx, it occurred thirty-one times in persons previously healthy, and twenty-five times in patients convalescent or suffering from some other affection. In Sestier's statistics there was not a single child among the patients previously healthy, but there were two children, between the ages of four and six years, amongst those already suffering from other diseases. The greatest number of cases occurred between twenty and fifty years of age, and the affection was twice as frequent amongst men as women. The pharyngeal inflammation was in many cases moderate and even slight, but the œdema of the larynx generally supervened during the height of the faucial inflammation.[1] It is highly probable that many cases of contiguous œdema are of an erysipelatous nature, though it is often difficult to determine whether the disease is a true phlegmasia or an example of collateral œdema. As a sequel to diphtheritic inflammation of the fauces, acute œdema was only noticed by Sestier three times in his 245 cases. Contiguous œdema rarely commences in the trachea and ascends to the larynx, Sestier[2] having only been able to find two very doubtful cases. Sometimes it follows aneurisms of the aorta or vessels of the neck, and in these cases it appears to be due to chronic inflammation of the cervical tissues, not to obstructed circulation.

*Consecutive œdematous laryngitis* almost always results from disease of the cartilages or perichondrium, but it may follow any deep-seated or extensive ulceration.

Acute œdema not unfrequently occurs as a *secondary* phenomenon. The acute diseases in which it is most apt to occur are small-pox and typhoid fever, but it is occasionally met with in scarlet fever, and Boeckel[3] has published a case supervening on ecthyma. It may occur during the progress of chronic tubercular or syphilitic inflammation of the larynx, though *chronic* œdema is a much more frequent sequel of these conditions. It is also occasionally found in post-scarlatinal dropsy, and sometimes in Bright's

[1] Op. cit. pp. 70 and 71.
[2] Ibid. p. 99.
[3] "Annales des Maladies de l'Oreille et du Larynx," vol. i. p. 387.

disease. Dr. Fauvel[1] has, indeed, pointed out that acute œdema of the larynx may be the first symptom of renal disease. This form of secondary œdema has also been noted by Gibb[2] and others.[3] It must, however, be very rare in Bright's disease, as some years ago at the London Hospital I examined 200 cases of this complaint without finding œdema of the larynx in a single instance. In the same way it is seldom present in general anasarca, and from the rarity of its appearance in this condition—a condition in itself so common—Sestier[4] thinks that "the intervention of a phlegmasia of the pharynx and larynx or neighbouring tissues is nearly always necessary." The same argument applies to Bright's disease.

*Symptoms.*—The prominent symptom of œdematous laryngitis is the gradually increasing impediment to respiration. The patient at first experiences the sensation of a foreign body in the throat, and, after a short time, a difficulty of breathing, which ultimately threatens suffocation. At the same time deglutition is rendered more or less difficult according to the amount of swelling of the epiglottis, and the voice gradually becomes weaker and altered in timbre, until at last it is almost extinct. There is not, generally speaking, any cough or expectoration, properly so-called, but the patient usually makes violent efforts to clear his throat of the obstruction, and frequently succeeds in spitting up a little frothy mucus. To the observer, the symptoms of the malady, when fully established, are most striking and painful. The efforts of the sufferer to draw breath are from the first very evident; and, as the disease advances, the phenomena of orthopnœa are highly distressing. Inspiration is accompanied by a whistling sound, which is very characteristic of the narrow condition of the glottis. The dyspnœa is, to a greater or less extent, constant, but paroxysms occur from time to time, any one of which may prove fatal. In these attacks the patient sits up in bed, with his mouth open, and gasps for breath. His eyes start from his head, and his whole body often trembles with an intense convulsive movement. A general cyanosis after a time commences, the face becomes of bluish hue, and, if nature or

[1] "Aphonie Albuminurique." Rouen, 1863.

[2] Op. cit.

[3] See Specimen No. 179,650 in Guy's Hosp. Mus.; also "Lancet," 1863, vol. ii. p. 277, and 1864, Feb. 27.

[4] Op. cit. p. 123.

art does not afford immediate relief, death rapidly occurs from asphyxia.

Physical examination of the part may be made by the finger or by the laryngoscope, but the latter alone gives reliable information. If the finger is passed into the throat great gentleness must be exercised, as otherwise we may produce a dangerous suffocative paroxysm.[1] The epiglottis may be felt to be very much thickened, and the ary-epiglottic folds may have attained such a state of tumefaction as to convey to the finger an impression similar to that which is given by touching the tonsils.[2] When the laryngoscope can be used the aspect of the parts is very characteristic. The colour of the mucous membrane is generally bright red. The epiglottis has the appearance of a semi-transparent roll-like body or ridge, or, losing its normal contour altogether, it presents two round red swellings pressed against each other. It is often merely erect and tense. It is this condition of the epiglottis which explains the pain and difficulty accompanying the act of swallowing. In many cases the swollen epiglottis blocks the view of the interior of the larynx. Occasionally, however, the ary-epiglottic folds appear distinctly as two translucent folds, which almost meet over the entrance to the larynx, and often touch each other in the median line at each effort of inspiration. It rarely happens that the vocal cords themselves are infiltrated, but a case of this kind has been reported by Risch,[3] and I have twice met with a similar condition in tertiary syphilis.

Sometimes the œdema is limited to that part of the larynx which is below the level of the vocal cords. This form of œdema was first accurately described by Gibb,[4] under the name of "subglottic" œdema, though Sestier[5] and Cruveilhier[6] had previously made some allusions to such a condition. In these cases there is generally no swelling above the vocal cords. I have met with many examples of sub-glottic œdema, but they have all been of a chronic character.

*Pathology.*—On close inspection of the œdematous larynx in the dead subject, the physical appearances of the part as

[1] Trousseau: "Clinique Médicale," t. iii. art. "Œdème de la Glotte."
[2] Krishaber: "Dict. des Sc. Méd." vol. ii. p. 618.
[3] "Berliner Klin. Wochensch." 1866, No. 33.
[4] Op. cit. p. 211.
[5] Op. cit.
[6] "Anat. Patholog." t. i. l. ii. pl. ii. fig. 1.

viewed during life with the laryngoscope are confirmed, whilst the pathology of the condition can be accurately determined. Where death has resulted from the œdema, the fluid collected in the sub-mucous connective tissue is generally of a serous character, but it may be sero-purulent, or even healthy pus. In the latter case the pus is always diffused, circumscribed abscess never occurring as a sequel of acute inflammation of the larynx. Pure serum is found only in the most acute and rapidly fatal cases ; as a rule the effusion is of a sero-purulent character. Occasionally blood is found in the tissues, especially in those cases which have run a rapid course.[1] On cutting into the diseased parts usually but little exudation takes place, and sometimes even squeezing between the fingers does not suffice to cause the disgorgement of the œdematous structures. As the morbid process so often extends from the pharynx, the brunt of the inflammation often falls on the epiglottis, and this valve is occasionally found enormously tumefied. But as the effusion collects where the areolar tissue is most lax, the ary-epiglottic folds are the parts which are most frequently distended, and in which the swelling attains its maximum. Next in frequency the ventricular bands suffer, whilst the vocal cords may be slightly tumefied, but are rarely swollen to any extent. In very rare cases the œdema can be traced down the trachea to the commencement of the bronchi. The muscles are frequently saturated with serous fluid. If the patient survive the acute stage and die from other causes, the parts previously œdematous present a sodden and shrunken appearance. In contiguous œdematous laryngitis the neighbouring structures are more or less implicated in the morbid process, and the cellular tissue of the pharynx, tonsils, soft palate, uvula, and even of the neck, is often found distended with fluid.

*Diagnosis.*—Previous to the invention of the laryngoscope, œdema of the larynx was liable to be confounded with several other maladies, and where some obstacle prevents the use of the instrument, the diagnosis may still occasionally be doubtful. It is, however, only necessary to enumerate such conditions—laryngismus stridulus, polypus, retropharyngeal abscess, and foreign bodies in the larynx—in order to prevent the careful practitioner from falling into error. Laryngeal diphtheria may sometimes mislead

[1] Sestier: Loc. cit.; also Pfeufer: "Henle u. Pfeufer's Zeitschrift für rat. Med." Neue Folge. Bd. iii.

the observer, but the presence of false membrane, which can generally be seen in the pharynx or may be coughed up in shreds, determines the diagnosis. Any disease which gives rise to dyspnœa, such as aneurism of the aorta, narrowing of the trachea, cervical tumours, &c., may simulate œdema of the larynx, but the history of the case and the laryngoscopic examination will generally furnish conclusive evidence as to the real nature of the malady.

*Prognosis.*—Except in slight cases, or where the œdema is partial—affecting one ary-epiglottic fold or one side of the epiglottis only—the prognosis is extremely unfavourable. Even when local measures have removed the obstruction to free respiration, the patient is very likely to perish subsequently from exhaustion, or blood-poisoning, or from pneumonia or other lung complications. Dealing roughly with the literature of the subject, Sestier[1] found that the affection proved fatal in 158 out of 213 cases in spite of tracheotomy having been performed thirty times. In the fifty-eight cases which recovered, the trachea was opened twenty times. Bayle,[2] however, gives much less favourable figures, for he reports seventeen cases with sixteen deaths. *Secondary* œdema is more fatal than *primary*. The prognosis also depends on the kind of œdema as well as on the age and sex of the patient. *Typical* œdema is almost always fatal, whilst the *contiguous* form generally does well, if the inflammation starts from the pharynx. It is, however, invariably fatal when it spreads from the neck or chest, as in the case of aneurism of the aorta or of the large cervical vessels, and nearly always so when it commences in the external areolar tissue. In *consecutive* œdema, the local affection being almost always at the same time a secondary phenomenon, the prognosis depends on the nature of the original disease. In typhoid fever it is very unfavourable, whilst in phthisis the condition is in itself comparatively unimportant, and in syphilis it usually yields to treatment. The affection is more serious in men than in women. According to Sanné, in the former four-fifths of the cases prove fatal, and in the latter only three-fifths. The same author states that the greatest mortality (in proportion to those affected) occurs between ten and thirty years, when eight-ninths of the cases prove fatal. The next highest mortality is between fifty and seventy, whilst the maximum power of resistance appears to

[1] Op. cit. p. 241, et seq.
[2] Op. cit.

be between thirty and forty and forty and fifty, in which two decennia, about one-half of the cases, according to Sestier, prove fatal.

*Treatment.*—Prompt local treatment must be adopted in order to remove the laryngeal obstruction. Local bleeding, by means of leeches placed over the sides of the larynx, is often of considerable service, and in mild cases may effect so much reduction in the œdema as to render the subsequent progress of the case free from danger. The inhalation of pulverized liquids, especially of a solution of tannin as recommended by Trousseau,[1] may also be tried. Ice should be uninterruptedly swallowed, and the patient should be kept constantly under the influence of bromide of potassium. It will usually, however, be necessary to carry out some more decisive measures. Scarification, first practised by Lisfranc,[2] is often successful when the disease is circumscribed. This operation may be performed by means of a long, sharp-pointed bistoury, covered, except for the last quarter inch of its length, with adhesive plaster or lint. The best instrument, however, for the purpose, is the laryngeal lancet (page 253). A primitive method of scarifying the larynx was practised by Legroux,[3] who lacerated the mucous membrane with one of the finger nails specially sharpened to a point for the purpose. After scarification, gargling with warm water and steam inhalations will much facilitate the expulsion of fluid from the tissues. If scarification is unavailing we must have recourse to tracheotomy, and it is better to perform this operation early, than to wait until an almost moribund condition of the patient renders surgical interference nearly hopeless.

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### Traumatic Laryngitis.

Violent inflammation of the larynx, involving the submucous areolar tissue, may arise from scalds of the larynx, from corrosive poisons, or from the impaction of foreign bodies.

*Scalds of the larynx* are frequently met with amongst children of the labouring classes. This accident, which is seldom seen except where English customs prevail, was first

[1] Loc. cit.
[2] "Journal de Méd." 1823: "Mém. sur l'Angine lar. œdémat."
[3] "Journ. des Connaiss. Médico-Chir." Sept. 1839.

described by Dr. Marshall Hall,[1] and subsequently by Stanley,[2] Burgess,[3] Wallace,[4] Ryland,[5] and Liston.[6] At a later period Jameson[7] reported several cases, and more recently Bevan,[8] Ross,[9] Jonathan Hutchinson,[10] Parker,[11] and others have recorded instances of the accident. These scalds are indeed far too common at all the general hospitals, and when I was Resident Medical Officer at the London Hospital, many cases came under my notice. Children allowed to drink tea from the spout of the tea-pot, unaware of the danger, occasionally attempt the same feat with the boiling kettle. Instant inflammation of the pharynx and orifice of the larynx sets in, and in two or three hours, or even sooner, the epiglottis becomes greatly swollen and œdematous.

The age of the patient usually renders the use of the laryngeal mirror out of the question, but the fauces should be illuminated as in laryngoscopy. Under these circumstances the erect and œdematous epiglottis can often be seen at the back of the tongue. Scarification is the most rational method of treatment. If the proper laryngeal lancet be not at hand, the œdematous parts may be incised or punctured with a gum lancet, or a curved, sharp-pointed bistoury, protected by strips of plaster to within two or three lines of its extremity. Non-depressant emetics may be given either before or after scarification, the pressure which the act of retching exercises on the œdematous tissue favouring the effusion from the ruptured, or punctured, mucous membrane. Scarification, fairly and fully carried out, ought to supersede all other treatment, and is much to be preferred to leeches and mercurials.

Tracheotomy may be had recourse to as a last resort, though it cannot in these cases lay claim to the success which attends its timely performance in many other cases of laryngeal obstruction.

*Laryngitis from corrosive poisoning* is generally of a very violent character, and is frequently followed by gangrene. Tracheotomy is often called for.

*Laryngitis from the presence of a foreign body* can only be relieved by the extraction of the offending substance. The sudden swelling which takes places in some of these cases

[1] "Trans. Med.-Chi. Soc." London, 1822. [2] Ibid.
[3] "Dublin Hosp. Reports," vol. iii. [4] "Lancet," March, 1836.
[5] Op. cit. [6] "Lancet," 1839 & 40, p. 103.
[7] "Dublin Quarterly Journ." Feb. 1848. [8] Ibid. Feb. 1860.
[9] "Medical Press and Circ." 1868. [10] "Lancet," Feb. 1871.
[11] Ibid. May 1, 1875.

partakes of the character of venous obstruction, such as may be artificially produced by tying a piece of string tightly round the end of the finger. The rapidity—often only a few minutes, or even seconds—with which the tumefaction takes place, far exceeds anything that can be accounted for by inflammatory action. Should it not be possible to effect the removal of the foreign body, tracheotomy must be performed if the symptoms are at all urgent.

## ABSCESS OF THE LARYNX.

(*Under this head abscess of the larynx dependent on perichondritis is not considered.*)

*Latin Eq.*—Abscessus laryngis.
*French Eq.*—Abcès du larynx.
*German Eq.*—Abscess des kehlkopfes.
*Italian Eq.*—Ascesso della laringe.

DEFINITION.—*A circumscribed collection of pus due to inflammation of the soft tissues of the larynx, interfering with the vocal functions of that organ, and sometimes with the proper action of the epiglottis.*

*Etiology.*—The causes of the disease are the same as those which give rise to diffused inflammation of the larynx. The affection is extremely rare, and generally occurs in an acute form.

*Symptoms.*—Dysphonia or aphonia, dysphagia, and occasionally dyspnœa are the ordinary symptoms. Which function is most involved depends on the exact seat of the affection. Tobold [1] has reported one case in which the left ary-epiglottic fold was the seat of the disease, and another in which the cushion of the epiglottis was affected. Generally the abscess develops within the larynx, or in the lower part of the pharyngeal cavity, but occasionally, as in a case reported by Rühle,[2] it points externally. If the abscess is not opened, it is extremely likely to cause suffocation, but in some cases it bursts spontaneously, and a cure results.[3] I

[1] "Laryngoscopie." Berlin, 1874, p. 324.
[2] "Kehlkopfkrankheiten." Berlin, 1861, p. 162, et seq.
[3] Schroetter: "Klinik für Laryngoskopie," Jahresbericht. Wien, 1870, p. 15.

have myself met with thirteen cases of idiopathic abscess of the larynx. In six cases, the abscess occurred at the root of the epiglottis; in four, in one of the ventricular bands; and in three instances, one of the ary-epiglottic folds was the seat of the disease. In most of my cases the symptoms were very severe: in nine the abscess was opened with a laryngeal lancet, and in four the abscess burst. All the patients recovered.

*Diagnosis.*—It is very difficult to diagnose this affection with certainty, for as there is generally a considerable amount of inflammation around the abscess the appearance is that of an acute inflammatory swelling. Sometimes, however, the abscess actually points, and the yellow colour of the pus can be detected through the mucous membrane. As Professor Bruns[1] has pointed out, this yellow colour is the only certain laryngoscopic sign of abscess, but sometimes the disease may be differentiated from œdema by the swelling being less transparent in the former case.

*Prognosis.*—The prognosis is generally favourable, if the abscess has not attained a very large size when it first comes under treatment. In pre-laryngoscopic times the disease has been reported to have been quickly fatal in several cases. Döring[2] recorded a case in which a soldier died on the third day from an abscess at the base of the epiglottis.

*Treatment.*—If the abscess is small it should be immediately opened with a laryngeal lancet, and if it has spread towards the skin, the opening should be made externally. In the case treated by Rühle, already referred to, a fluctuating tumour was felt with the finger, at the upper aperture of the larynx, and there was a swelling over the left ala of the thyroid cartilage. After using an exploratory needle an incision was made externally, and a cupful of pus was evacuated. The patient was cured in a few days. If the abscess is very large, tracheotomy should be performed, and after Dr. Semon's tampon-canula (see Tracheal Instruments) has been inserted, the abscess should be opened in the ordinary way.

[1] "Laryngoscopie." Tübingen, 1873, p. 132.
[2] Rühle: Op. cit.

## CHRONIC LARYNGITIS.

(Synonym: Chronic Catarrh of the Larynx.)

*Latin Eq.*—Laryngitis chronica.
*French Eq.*—Laryngite chronique.
*German Eq.*—Chronischer Catarrh des Kehlkopfs.
*Italian Eq.*—Laryngitide cronica.

Definition.—*Chronic inflammation of the lining membrane of the larynx characterized by hoarseness or loss of voice, and generally by more or less cough. Occasionally the malady causes thickening of the affected membrane, and sometimes leads to ulceration.*

*Etiology.*—The causes of this affection are the same as those indicated under the head of acute laryngitis, to which disease it often proves the sequel. It sometimes results from too prolonged use of the voice, especially among clergymen and schoolmasters. The chronic forms of inflammation also frequently extend from the pharynx, and the effects of continuity of texture are often seen in chronic alcoholism and the abuse of tobacco. It is commonly supposed that elongation of the uvula by mechanically irritating the epiglottis and orifice of the larynx is an almost certain cause of chronic laryngitis. I have seen several cases in which an obstinate and teasing cough, together with some congestion of the larynx, were apparently produced, or at least maintained, by an elongated uvula, the affection subsiding almost immediately after a portion had been snipped off; but on the whole I am inclined to agree with Ziemssen[1] that the causal influence of this condition has been greatly overrated, and that Rühle[2] is correct in observing that the enlargement of the uvula and laryngeal malady are merely co-existent effects of the same cause — chronic pharyngitis.

The influence of an atmosphere impregnated with atomic matter, in the production of disease, has long been recognized. In the last century, Bubbé,[3] Ramazinni,[4] and others, drew attention to this cause of morbid action, and in our own

[1] "Cyclopædia of Medicine," vol. iv.
[2] "Die Kehlkopfkrankheiten." Berlin, 1861.
[3] "Dissert. Inaugur." &c. Halæ, 1721; "Hufeland's Journ." vol. xcviii. p. 4.
[4] "Abhandlungen von den Krankheiten der Künstler und Handwerker," translated by Ackermann. 1780, vol. i. pp. 123, 147; vol. ii. p. 27.

time, Holland,[1] Heussinger,[2] Virchow,[3] Lewin,[4] Headlam Greenhow,[5] and other physicians have further elucidated the subject. It need, therefore, only be observed here that the larynx suffers in common with the rest of the respiratory system in the case of needle grinders, pearl-button turners, and others who work in an impure atmosphere, the chronic form of catarrh being especially common amongst persons so occupied.

The great and sudden development of the larynx which takes place at puberty in males is often attended by chronic laryngitis, the so-called "cracked voice" of boys being always associated with marked congestion of the vocal cords. There seems also to be a rare constitutional condition, where there is a tendency to chronic inflammation of many of the mucous canals. Seven such cases have come under my notice, all the patients being men over fifty years of age. I had at one time a gentleman under my care who was suffering from chronic laryngitis, slight thickening of the walls of the lower third of the œsophagus, gastro-intestinal derangement, and chronic cystitis.

The influence of age and sex is very marked in cases of chronic laryngitis, adult males being by far the most common sufferers, and children the rarest. As a secondary phenomenon chronic laryngitis is, of course, almost invariably present in all long-continued diseases of the larynx, such as phthisis, syphilis, polypi, cancer, lupus, &c.

*Symptoms.*—The subjective symptoms of chronic laryngitis vary considerably under different conditions. When the patient refrains from using his voice, the local sensations are not very marked, some dryness and irritation in the throat, with occasional tickling cough, being all that is complained of. If the patient, however, exercises his voice for any length of time, these symptoms become much aggravated, and he is soon obliged to seek relief in silence. In some cases, in addition to the symptoms above mentioned,

[1] "Diseases of the Lungs from Mechanical Causes, and Inquiries into Conditions of Artisans exposed to the Inhalation of Dust," by Dr. G. Calvert Holland. London, 1843.

[2] "Ueber anomale Kohlen- und Pigmentbildung." Eisenach, 1823.

[3] "Anatomische Beschreibung der Krankheiten der Circulations- und Respirationsorgane." Leipzig, 1841.

[4] "Beiträge zur Inhalationstherapie in Krankheiten der Respirationsorgane." Berlin, 1863.

[5] "Chronic Bronchitis." London, 1870.

a burning or pricking pain is felt, and there is often a frequent desire and effort to clear the throat.

Objectively, the phenomena of chronic laryngitis consist in a marked alteration of voice and a slightly increased secretion, and in certain definite anatomical changes. Impairment of the function of the larynx is the most characteristic symptom of the disease. It varies in degree from slight modification in tone to complete loss of voice. It is characteristic also of this form of hoarseness *in the early stage*, that it is most marked when the organ has been at rest for some time. Thus, a patient with slight chronic congestion may be extremely hoarse on attempting to speak after an interval of silence, and yet the voice will become almost normal after the function has been exercised for a few minutes. The improvement probably depends on the quickened capillary circulation and stimulated nerve-force of the part, and has its analogy elsewhere. If, however, the patient continues to talk for a time, fatigue is experienced, and hoarseness or aphonia supervenes. In chronic laryngitis the voice is sometimes clear and natural in its ordinary tones, and the discordance is only observed when powerful exertions are made (as in singing, acting, public speaking, &c.). The cough is generally rather frequent, but it may amount to nothing more than "hawking," or "hemming," and sometimes it is almost entirely absent. In some cases, however, it constitutes the most troublesome symptom.

As regards *secretion*, the expectoration is never abundant, unless the laryngeal affection be complicated with bronchitis. The mucus discharged from the larynx is generally of a whitish-grey colour, and of viscid consistency, but in cases of long standing it is yellower, and after violent exacerbations of coughing, frequently appears streaked with blood. Respiration is seldom much affected, but moist râles can generally be heard over the larynx.

*The laryngoscopic appearances* are usually very marked, but vary considerably in different cases. A general or partial hyperæmia is invariably present. The redness is generally suffused and fades off gradually into the healthy-coloured membrane, but injection of the minute vessels is sometimes apparent, especially on the epiglottis and vocal cords. On the former the injection is usually arborescent, on the latter the arrangement of the vessels is generally linear, along the attached side of the vocal cord. Sometimes one vocal cord is seen to be bright red, whilst the

other is of the usual white colour, and the congestion may even be limited to a small portion of one cord. In the latter case it is always the outer attached portion of the cord which is congested. Small pellets of mucus are often seen sticking to different parts of the laryngeal membrane; and in cases of long standing, the whole surface of the larynx is frequently covered with secretion. In some cases the mucous membrane, instead of presenting the velvety appearance which generally accompanies any pronounced congestion, looks dry and glistening. General tumefaction of the mucous membrane and submucosa is a very pronounced feature in inveterate cases, the epiglottis, ventricular bands, and inter-arytenoid fold all participating in a diffuse and uniform thickening. In the case of the vocal cords this change sometimes causes a granular condition of their surface, and often a very perceptible unevenness of their edges. *Derangements in the mobility of the larynx* may often be noticed. Some of these phenomena are of a mechanical nature, and depend on muscular action being clogged and impeded through the thickened state of the mucosa and sub-mucosa. Thus the hypertrophied inter-arytenoid fold prevents the normal approximation of the arytenoid cartilages and vocal cords; while the swollen ventricular bands sometimes almost obliterate the ventricles of Morgagni, and encroaching on the vocal cords, materially impede their movements. In addition, however, to these mechanical effects, true muscular pareses of peripheral origin are often present; in such cases, as Ziemssen[1] observes, the paralysis is more often unilateral than bilateral. Where only one cord, however, is paralyzed, the impaired movement is made up for by increased activity on the part of its fellow, which is dragged across the middle line, beyond its usual range of movement. By this means approximation and phonation are secured, and in such instances obliquity of the closed glottis can be seen with the laryngoscope.

Erosions, or very fine shallow ulcerations, which extend no deeper than the epithelial layer, are not unfrequently visible. Their most frequent seat is between the arytenoid cartilages and on the cartilaginous portion of the vocal cords. Ulcerations, which pass through the whole thickness of the mucous membrane, are of very rare occurrence in this affection, and perichondritis is very seldom met with, except in the subglottic regions.

[1] Loc. cit. p. 216.

In addition to congestive swelling of the mucosa and sub-mucosa, there occurs in some rare cases an organic thickening or hypertrophy of the soft structures. The epiglottis, ventricular bands, and ary-epiglottic folds are occasionally affected in this way. Lewin[1] has specially noticed the thickening of the ary-epiglottic folds in preachers. He attributes it to the forcible depression of the epiglottis by the contraction of the muscular fasciculi contained in the ary-epiglottic ligaments — a movement necessary to produce the deep, hollow tones which express pathos. It must be observed, however, that swelling of the ary-epiglottic folds is exceedingly rare in this country except in laryngeal phthisis, and the inter-arytenoid fold is far more frequently thickened; nodular excrescences, the result of chronic inflammation, are often met with.

*Pathology.*—The disease is essentially a chronic inflammation of the lining membrane of the larynx, in which the vessels of the areolar tissue participate very little. Enlargement and tortuosity of the small vessels is found in cases of long-standing congestion, together with increase of the connective tissue, while the sub-epithelial portion of the mucosa is often converted into a lymphoid tissue. The latter by encroaching on the epithelium gives rise to the superficial erosions seen during life.

*Diagnosis.*—An accurate opinion can only be formed by careful laryngoscopic examination. It is of the first importance in every case of supposed chronic laryngitis to observe whether there is thickening, and if this condition exists, to determine whether it is due to inflammatory tumefaction, œdematous infiltration, or tuberculous deposit. In simple chronic laryngitis, the natural contour of the parts is almost always preserved, but the coloration is somewhat redder than that of health. In œdema the swelling is generally of a bright colour, and has a characteristic transparent appearance; in phthisis, on the other hand, the thickened parts are usually of a dull colour, though the surface may be accidentally congested; the swelling also, as a rule, presents certain determinate forms, which will be described in treating of that disease. In all cases of chronic laryngitis of some months' standing the lungs must be most carefully examined, the history of the patient and that of his family closely investigated, and his general condition inquired into, before a decided opinion as to the nature of the disease is given.

[1] "Virchow's Archiv." Bd. xxiv. p. 429.

*Prognosis.*—The tendency of the disease when once fully-established is to remain stationary, or the symptoms may disappear for a short time and then recur. Under persistent local treatment and the careful avoidance of the exciting causes of the affection, however, recovery can generally be secured. In old people the malady is always complicated with chronic bronchitis, and the symptoms of the latter affection mask and outweigh in importance the morbid phenomena dependent on the chronic laryngeal disease. Chronic laryngitis hardly ever terminates fatally, almost the only possibility of such an occurrence consisting in the supervention of perichondritis, and such an issue is excessively rare, except when the disease occurs in the subglottic region.

*Treatment.*—Local remedies of an astringent character are the most important agents in the treatment of chronic laryngitis. Any of the following "Pigmenta" (Throat Hosp. Phar.) may be used:—Ferri perchlor. (60 gr.), ferri persulph. (60 gr.), ferri sulph. (120 gr.) cupri sulph. (10 gr.) zinci chlorid. (30 gr.), zinci acet. (5 gr.), zinci sulph. (10 gr.), aluminis (30 gr.), alum. chlor. (60 gr.), dissolved in an ounce of water or glycerine. The latter solvent, through its denser consistency, is better adapted for keeping up a prolonged action on the part. Solutions of the crystals of nitrate of silver were strongly recommended by Green[1] in follicular cases, but they do not seem to me to act more beneficially than other mineral astringents. The solution of chloride of zinc is the remedy I most frequently employ; but provided the medicament is applied accurately and sufficiently often, it really matters very little which solution is used. The application should be made daily for the first seven days, on alternate days during the second and third week, twice in the third week, and so on, at gradually increasing intervals till a cure is effected. This is a general rule, but it must be modified according to circumstances. In cases where there is excessive secretion from the larynx (laryngorrhœa), the local application of turpentine sometimes does good, but these cases are generally very troublesome to treat. On the other hand, when there is long-standing hyperæmia, with diminished secretion—where the mucous membrane looks dry and shining—the remedy which I have found most successful is carbolic acid (from half a

[1] "On Bronchitis." New York, 1846.

drachm to a drachm of the pure white carbolic acid to an ounce of glycerine).

Another mode of applying astringent solutions to the larynx consists in the use of spray-producers (see page 246). For spray-inhalations the following remedies are most to be recommended, tannin being probably the best of all; the proportions given are always for one ounce of water:—Tannin, 1 to 5 gr.; alum, 1 to 10 gr.; perchloride of iron, $\frac{1}{8}$ to 2 gr.; sulphate of zinc, 1 to 6 gr.; chloride of zinc, 2 to 10 gr. Whichever solution is selected, it should be employed three or four times a day for about five minutes. It must be understood, however, that this method of local treatment is generally only of service as a supplement to applications made with the brush.

In many cases great benefit is derived from steam inhalations containing some stimulating volatile principle. For this purpose the inhalations of pine oil, creasote, and juniper (Throat Hosp. Phar.) are among the best. Steam inhalations should, as a rule, be employed twice or three times daily for about ten minutes, at a temperature of 140°.

When persistent congestion has led to pareses of the laryngeal muscles, the systematic employment of internal electricity is of the greatest value. In fact, cases of this class seldom yield to any other treatment.

It is almost unnecessary to observe that the voice should be exercised as little as possible. For singers, actors, clergymen, and others, whose occupations require them to use the voice much, rest of the vocal organ is of the utmost importance. When complete silence cannot be enforced, the least possible exertion should be made in speaking—the patient should, in fact, whisper. If the uvula be much elongated it had better be amputated. As the pharynx is almost invariably more or less affected, astringent lozenges (Throat Hosp. Phar.) will be found very useful. Tannin, rhatany, and kino may often be prescribed in this form with great advantage.

The waters of Ober-Salzbrunnen, Ems, and Selters are especially recommended by Niemeyer,[1] who observes that "we must accept the empirical facts that these waters relieve and cure very many cases of chronic laryngeal catarrh;" whilst French physicians praise the sulphuretted waters of the Pyrenees, especially of Les Eaux Bonnes, as being appropriate to cases associated with granular pharynx.

[1] "Lehrbuch der Spec. Pathol. u. Therap.," 7te Aufl. p. 13.

Several patients whom I have sent to the Pyrenean springs have derived undoubted benefit from the use of those waters, but, on the whole, I have seen more benefit result from the waters of Aix-les-Bains and Marlioz. The climate of the Pyrenees is sub-tropical, and generally very ennervating in its effects on English patients. I can particularly recommend the hot sulphur-waters of Savoy when the voice remains weak and the mucosa is relaxed rather than congested.

Where suitable atmospheric conditions cannot be selected the patient must wear a respirator, when the weather is at all cold or damp, and must protect the neck and body generally by warm and suitable clothing. Constitutional medicines and hygienic treatment will be necessary in some cases, and must vary according to circumstances.

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### Chronic Glandular Laryngitis.

This condition consists in an inflammation in which the minute racemose glands are principally affected. It is almost always associated with follicular pharyngitis,[1] of which malady it generally constitutes a downward extension. It cannot, however, be called "follicular laryngitis," as the glands of the larynx are all of the racemose variety (Kölliker). The term "clergyman's sore throat" has been applied to it, but the clergy more often suffer from congestion of the whole mucous membrane and pareses of the laryngeal muscles. Although usually resulting from a previous pharyngeal affection, it sometimes commences in the larynx, and afterwards reaches the pharynx. It is often associated with indigestion, but whether there is any causal relation between the two conditions is uncertain. The symptoms are the same as those of simple chronic laryngitis, but perhaps milder—weakness of voice, fatigue after speaking, a constant inclination to clear the throat and swallow the saliva, or perform an act of deglutition, being the principal morbid phenomena. With the laryngoscope the enlarged orifices of the glands may sometimes be seen on the epiglottis and the posterior parts of the vocal cords as pale specks on the congested membrane, or as small red circles on the pale membrane. The other laryngeal appearances do not differ from those of simple

[1] For a full description of this affection see "Granular Pharyngitis," p. 28.

laryngitis, except that the approximative action of the vocal cords is more often feeble and imperfect. There is frequently considerable constitutional debility. The treatment should, for the most part, be the same as for ordinary chronic laryngitis, but nitrate of silver (gr. xx. ad ℥j.) is more useful in this complaint, and the sulphur-waters of Aix-les-Bains are especially valuable. Constitutional remedies of an analeptic character are also generally required.

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### Phlebectasis Laryngea.

Venous congestion of the larynx is an extremely rare affection, and I have only met with four examples of it. It may depend on general or local causes, viz., it may occur "in persons affected with a morbid preponderance of the venous system" (Hasse), or may be due to a local strain. Duchek[1] considers that the dilatation of the veins is one of the aggregate results of chronic catarrh. This is probably a mistake, seeing how rarely we meet with phlebectasis, and how common is chronic laryngitis. As a sequel to the latter affection, *capillary* engorgement of a passive character is often met with, but *not venous* preponderance. The symptoms are generally slight; some alteration in the voice, an uneasy sensation in the larynx, and, perhaps, a more or less frequent cough, being the principal morbid phenomena. The laryngoscopic appearances may be thus described:—In mild cases, where the disease is very limited, extremely fine dark vessels may be seen running along the upper border of the ventricular orifice and epiglottis. In more severe cases there is less regularity in the distribution of the distended veins, which may be observed in the ventricular bands, vocal cords, and arytenoid cartilages. Cases have come under my notice in which streaks of blackened mucus adhering to the larynx have been mistaken for varicose veins—an error which needs only to be mentioned to be avoided. This condition of the larynx, independently of the inconvenience it occasions, is probably attended with some danger, as it most likely predisposes to passive œdema. Astringent solutions may do good, but the only treatment calculated to effect a permanent cure consists in destruction of the veins by electric cautery.

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[1] "Traité de Pathologie interne," vol. i.

### Trachoma of the Vocal Cords.

Very important organic lesions of the vocal cords are sometimes produced in persistent cases of chronic laryngitis. Amongst these a roughness of their surface, apparently arising from a partial dermoid metamorphosis of the mucous membrane,[1] is not uncommonly seen. This condition has been called *chorditis tuberosa*[2] or *trachoma* of the vocal cords, and appears to consist in a hypertrophy of the connective tissue and a proliferation of its nuclei.[3] I have met with it most frequently in the case of singers. These cases are often extremely obstinate, and sometimes defy all treatment, but generally a prolonged course of local remedies of a strongly astringent (Ferri Perchlor. ℥ij. ad ℨj.) or caustic nature (Argent. Nit. ℥j. ad ℨj.) in the end effects a cure.

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### Sub-glottic Chronic Laryngitis.

Chronic laryngitis in the sub-glottic region sometimes gives rise to considerable thickening of the tissues, especially at the under surface of the vocal cords. When the disease is well established the tumefaction often presents the appearance of a second vocal cord immediately below the true cord. Occasionally there is, so to speak, an interruption in the swelling, so that the projection can be seen below the vocal cord for a certain length, then a clear space, whilst further on the subcordal swelling is again apparent. The colour of the hypertrophied tissue is generally whitish-grey, but it is occasionally red; the surface too, though usually smooth, is in rare cases more or less ulcerated. Hoarseness is the first symptom of the disease, but complete aphonia generally occurs at a comparatively early period. Dyspnœa is also perceived as soon as there is any considerable amount of thickening, and attacks of urgent suffocation sometimes occur. This symptom, as Catti[4] has pointed out, results from the vocal cords becoming at parts agglutinated together by viscid mucus. Rokitansky[5] was the first to discover and describe this condition, and Czermak[6] shortly after published the details of a case in which he diagnosed the affection in a scrofulous girl by means of the

[1] "Traité de Pathologie interne," vol. i.
[2] Türck: "Klinik der Krank. d. Kehlkopfes," &c. Wien, 1866.
[3] Wedl. Ziemssen: Loc. cit.
[4] "Allgem. Wiener Med. Zeitung." 1878. No. 39, u.f.
[5] "Jahrb. d. Path. Anat." iii. Aufl. bd. iii. § 16.
[6] "Der Kehlkopfspiegel und seine Verwerthung. f. Phys. und Med." ii. Aufl. Leipzig, 1863, § 87.

laryngoscope. Türck[1] published a case in 1866, and Scheff[2] in 1871. In the same year Schroetter[3] reported three cases, and in 1873 Gerhardt[4] described the disease under the name of *Chorditis vocalis inferior hypertrophica.* Since then Burow[5] has published six cases, in all of which tracheotomy was found necessary. Catti[6] has reported six cases, four of which were watched for a considerable time, and two only seen casually. In the former tracheotomy was found necessary in one instance. Other practitioners have also recorded cases, but the most important article on the subject is that lately written by Professor Schroetter[7] which contains a good résumé of our present knowledge of the disease.

Considerable doubt exists as to the exact nature of this affection, though in some cases the patients are of marked scrofulous constitution. The immediate local cause generally appears to be persistent inflammation of the mucous membrane, and the swelling differs little from the hypertrophy of the inter-arytenoid fold and posterior wall of the larynx so frequently met with. Sometimes, as Schroetter points out, the affection seems to originate in the cartilage or the perichondrium, those structures being most frequently affected either just below the anterior commissure of the vocal cords, or on the inner surface of the sides of the cricoid cartilage—situations where, it must be remembered, the mucous membrane is in direct contact with the perichondrium, whilst in other parts the cartilage is more or less protected by the interposition of muscles. In each of the three cases in which I have had an opportunity of making a post-mortem examination there was disease of the cricoid cartilage, and of one of the arytenoid cartilages.

Ganghofner[8] thinks that the affection is only one of the symptoms of the curious disease which has been described by Stoerk[9] as "chronic blennorrhœa of the mucous membrane of the nose, larynx, and trachea." Although thickening in the

[1] "Klinik der Krankheiten des Kehlkopfs und der Luftröhre." Wien, 1866, § 204.

[2] "Wiener Med. Presse," No. 51, 1871, § 1313.

[3] "Laryngol. Mittheilungen," "Jahresbericht," &c. Wien, 1871; also "Beitrag zur Behandlung der Larynxstenosen." Wien, 1873.

[4] "Deutsch. Arch. f. Klin. Med." Bd. xi. 1873.

[5] Langenbeck's "Archiv. f. Klin. Chirurgie," bd. xviii. 1875 § 228.

[6] Op. cit.

[7] "Monatsschrift für Ohrenheilkunde," &c. No. 12. 1878.

[8] Ibid.

[9] "Klinik. der Krankheiten des Kehlkopfes," Hälfte, i. Stuttgart, 1876.

sub-glottic region no doubt often takes place in the form of blennorrhœa just referred to, yet, on the other hand, it is certain that it very frequently occurs quite independently of that affection. Schroetter, with reason I think, objects to the term "chorditis vocalis inferior hypertrophica," inasmuch as it localizes too narrowly a pathological condition which may affect any part of the larynx. Rokitansky considers the disease as an indurative metamorphosis of the mucosa and sub-mucosa.

Sub-glottic chronic laryngitis is not so rare as is generally supposed, for between 1864 and 1872 nineteen cases came under the care of myself and colleagues at the Hospital for Diseases of the Throat, and I saw four cases at the London Hospital.[1] In every instance the disease was confined to the sub-cordal region, having been unilateral in sixteen cases, and bi-lateral in nine. But were I to include cases in which the inter-arytenoid fold was affected, together with the posterior portion of one or both of the vocal cords, I should be able to mention many more cases. In five of the twenty-three cases the swelling was partly translucent, and hence, no doubt, to some extent œdematous, but in the remaining eighteen it appeared solid.

When once the disease is fully established there is no difficulty in distinguishing it, the only question which can arise is that which has reference to the density of the swelling. In the œdematous cases the swelling is generally round in outline, resembling a nasal polypus, and can scarcely be mistaken for the more substantial form of hypertrophy.

In all sub-glottic diseases the prognosis is relatively much more unfavourable than where the affection is supra-glottic. We see this in the case of benign growths, in œdema, and in cicatricial contractions. The difficulty of treating disease locally in this situation is so enormously increased that the more unfavourable prognosis will be readily intelligible. The prospect of the patient may be inferred from a brief reference to my twenty-three cases. In three of them Mr. Evans performed tracheotomy (1866), whilst in the previous year I opened the trachea in two cases referred to me by Dr. Patrick Fraser. Subsequently, between 1866 and 1872 (inclusive), I performed tracheotomy in five other similar cases. Of the nine patients operated on either by Mr. Evans

[1] I have seen a number of cases since 1872, but unfortunately have not sufficiently detailed records to make use of them. My colleague, Dr. Whistler, informs me that he also not unfrequently meets with instances of the disease.

or myself, two were subsequently able to dispense with the canula, the sub-glottic obstruction having been got rid of mainly by the use of my dilator (Fig. 50, page 261). Of the remaining seven, three died after fifteen months, nineteen months, and twenty-seven months respectively. Of the thirteen cases not operated on, four, I believe, died without tracheotomy, in five the swelling disappeared under treatment, and in four instances the disease remained stationary for some months, and I ultimately lost sight of the patients. I have found it necessary to perform tracheotomy much less frequently in recent years, a circumstance which I attribute to my much earlier recognition of the disease.

Chronic laryngitis in the sub-glottic region should be treated with great assiduity, and, if possible, cured before any hypertrophy takes place. The plan of treatment recommended in the more common form of chronic laryngitis should be pursued, and if thickening occurs it should be met by the frequent passage of bougies or hollow vulcanite tubes, according to the plan laid down under Perichondritis. Even where there is considerable dyspnœa this treatment may be pursued, for as already pointed out the shortness of breath in these cases is often caused by collections of viscid mucus. The mucus is dispelled by the catheterism, and the patient often obtains immediate relief. Scarification is often of great service, and electric cautery has been successfully employed by Voltolini.[1] If, however, the dyspnœa becomes dangerous, tracheotomy must be performed. On recovery from the operation, dilatation of the larynx must be effected in the way hereinafter described.

## CHRONIC ŒDEMA OF THE LARYNX.

*Latin Eq.*—Œdema laryngis chronicum.
*French Eq.*—Œdème chronique du larynx.
*German Eq.*—Chronisches Glottisödem.
*Italian Eq.*—Edema cronico della laringe.

DEFINITION.—*Serous or sero-purulent infiltration of the areolar tissue of the larynx, chronic in character, and generally occurring as a concomitant of some other local morbid condition, such as laryngeal phthisis, cancer, or syphilis.*

*Etiology.*—Chronic œdema of the larynx is frequently the

[1] "Monatsschrift für Ohrenheilkunde," &c. 1878, No. 9.

sequel of the acute affection, and it is also a very common phenomenon in the course of serious structural changes of the larynx, such as occur in syphilis, laryngeal phthisis, and cancer. In the case of the two latter maladies, the primary affection being of an intractable nature, the associated œdema can only be regarded as a subject of pathological interest. In syphilis, however, although there may be great destruction of tissue, the fundamental disease is sometimes of less immediate importance than the infiltration to which it has given birth. I met with the affection 165 times in 500 cases of laryngeal phthisis seen during life, but it was present in 71 per cent. of the cases examined after death. Sestier[1] found the condition due to laryngeal phthisis in 15 out of his 245 cases. In 179 of my cases of tertiary syphilis of the larynx chronic œdema was present 32 times; it occurs in nearly every case of laryngeal cancer, as soon as the disease is well established.

*Symptoms.* — The *laryngoscopic appearances* of chronic œdema are somewhat similar to those described in the section on acute œdema, but the picture of the disease is modified by the phenomena of the primary malady, as well as by its slower rate of progress. The mucous membrane is generally much paler than in acute œdema. The disease comes on so slowly, that the patient gets habituated to the insufficient supply of air, and often appears to be little embarrassed even when the lumen of the larynx is greatly diminished.

*Diagnosis.*—A laryngoscopic examination at once reveals the condition of the larynx.

*Prognosis.*—This depends principally on the nature of the primary malady. Tuberculosis and cancer are necessarily fatal, but of course death may occur prematurely, through the intervention of serious œdema of the larynx. On the other hand, in syphilitic cases, the secondary œdema is of more immediate importance than the radical disease, and the best result can often be obtained by appropriate treatment.

*Treatment.*—Scarification is often of the greatest service in cases of phthisis and syphilis, but in cancer tracheotomy best promotes the comfort of the patient, and the prolongation of his life.

[1] Op. cit. p. 103. Pulmonary phthisis was present in three other cases, but in these instances the œdema spread from an inflammatory or purulent point external to the larynx.

## NON-MALIGNANT TUMOURS OF THE LARYNX.

(Synonyms: Benign Growths in the Larynx. Polypus of the Larynx.)

*Latin Eq.*—Polypi laryngis.
*French Eq.*—Polypes du larynx.
*German Eq.*—Larynxpolypen. Kehlkopfpolypen.
*Italian Eq.*—Polipi della laringe.

Definition.—*New-formations of benign character, forming projections on the mucous membrane of the larynx, generally giving rise to aphonia or dysphonia, often to dyspnœa, and occasionally to dysphagia.*

*History.*—Isolated cases of laryngeal polypus are to be found at a comparatively early date, the case in which Koderik successfully operated on a growth through the mouth, about the year 1750,[1] being one of the first described. Seventeen years later, Lieutaud[2] published 2 cases of undoubted laryngeal polypus. In 1833 Brauers,[3] of Louvain, attempted to remove a growth by thyrotomy. In 1836 Regnoli[4] recorded a case in which he extirpated a laryngeal growth through the mouth, after performing tracheotomy, and in the following year, Ryland[5] devoted several pages of his classical work to tumours of the larynx. It was not, however, until the year 1850 that a complete monograph appeared. Then it was that Ehrmann published his celebrated treatise[6] which included 31 cases of laryngeal growth. In the year 1851[7] Rokitansky brought forward 10 additional cases; and in 1852 Dr. Horace Green,[8] of New York, published 39 cases, 2 of which had occurred in his own practice.

[1] George Herbiniaux: "Parallèle des différens Instruments, avec les Méthodes de s'en servir pour pratiquer la Ligature des Polypes dans la Matrice, en forme de Lettre à M. Roux, avec Figures." A la Haye, chez Gosse et Percl. 1771. This case is quoted by Lewin: "Deutsche Klinik," March 29, 1862.

[2] "Historia Anatom. Med." lib. iv. observ. 63, 64. 1767.

[3] Cited by Ehrmann. (See Note 6).

[4] "Osservazione Chirurg." &c. Pisa, 1836.

[5] "A Treatise on the Diseases and Injuries of the Larynx and Trachea."

[6] "Histoire des Polypes du Larynx." Strasbourg, 1850.

[7] "Zeitschrift der k. k. Gesellschaft der Aerzte zu Wien." März, 1851.

[8] "Polypi of the Larynx and Œdema of the Glottis." New York, 1852. "Transactions of the American Medical Association," 1853.

In the following year Dr. Gurdon Buck collected 49 cases, including his own interesting example; and in 1854 Middeldorpf[1] brought together 64 cases. Finally, in the year 1859, Prat published a case in which he had removed a growth through the thyro-hyoid membrane.[2] Amongst all these cases there are only 9 in which an attempt was made to remove the growth during life, and one of these, viz., that by Koderik, already referred to, is so vague, that it must necessarily be excluded.

On the invention of the laryngoscope, laryngeal growths were investigated with great zeal, and cases were soon published by Czermak,[3] Lewin,[4] Gibb,[5] Fauvel,[6] Walker,[7] and others. In 1865 Professor von Bruns[8] issued a monograph containing 17 cases, and in the following year Dr. Louis Elsberg[9] published a prize essay containing 13 cases. In 1868 von Bruns[10] reported 23 additional cases. In the year 1871 I published a work[11] containing 100 consecutive cases operated on by myself (from 1862 to 1870), and 189 other cases—being all the cases reported up to that time in medical literature. Here I may, perhaps, be allowed to observe parenthetically, that I have since operated on 123 other patients (from May 25th, 1870, to December 31st, 1878). The conclusions, as regards the etiology and nature of the growths drawn from my second series, being almost identical with those derived from the first set, I have not thought it necessary in this article to alter the various percentages formerly arrived at. I may mention, however, that owing to the more careful exclusion of malignant disease, the results, as regards the restoration of voice and absence of recurrence, have been more favourable in my recent cases. In 1872, Stoerk[12] published 36 cases operated on (1871 and 1872), and in 1874 Tobold[13] reported 206 cases, with 70 operations (between 1861 and 1874). In the same year

[1] "Die Galvanokaustik." Breslau, 1854.
[2] "Gazette des Hôpitaux." 1859, No. 103, p. 809.
[3] "Wien. Med. Wochenschrift." January 8, 1859.
[4] "Deutsche Klinik," 1862.
[5] "Diseases of the Throat." Second Edition.
[6] "Du Laryngoscope au point de vue pratique," 1861.
[7] "Lancet," November, 1861.
[8] "Die Laryngoskopie," &c. Tübingen, 1865.
[9] "Morbid Growths within the Larynx." Philadelphia, 1866.
[10] "Polypen des Kehlkopfs." Tübingen, 1868.
[11] "Growths in the Larynx" London, 1871.
[12] "Laryngoscop. Operationen" Wien, 1871-72.
[13] "Laryngoscopie." Berlin, 1874.

Schnitzler[1] recorded 35 cases operated on (from 1872 to 1874). In 1875 Oertel[2] recorded 68 cases, 59 of which were operated on (between 1862 and 1874). In 1875 Schroetter[3] related 84 cases, 48 of which were operated on (from 1870 to 1873). In 1876 Hopmann[4] recorded 25 cases, with 18 operations (from 1870 to 1875). In the same year Fauvel[5] published 300 cases, with 220 operations (from 1862 to 1875). Between 1874 and 1876, Boecker[6] published 40 operations. In 1878 Paul Bruns[7] published a work on the relative merits of endo-laryngeal treatment and thyrotomy. This treatise is based on an examination of all the cases already referred to in this article, and includes besides 200 cases operated on by von Bruns (1868 to 1878), 35 cases operated on by Paul Bruns (1871 to 1878), and 75 other cases operated on by various laryngoscopists, amongst whom may be mentioned A. Burow, Labus, Navratil, Waldenburg, Voltolini, Beschorner, Schech, Sommerbrodt, Michel, Sidlo, Heinze, Halbertsma, Jelenffy, Scheff, Krishaber, Elsberg, Ruppaner, Hartman, and others. Since the issue of Paul Bruns' work, further cases have been published by Lefferts,[8] Clinton Wagner,[9] and others.

*Etiology.*—Chronic congestion of the laryngeal mucous membrane is, far above all other causes, the most important etiological feature, in the production of simple morbid growths in the larynx. In some cases the disease appears to originate in an acute or subacute form of inflammation, but it is generally only as the starting-point of chronic hyperæmia, that the more acute attack indirectly leads to the production of a new formation. The most common cause of hyperæmia is probably catarrh, and catarrh must therefore be looked upon as the great predisponent of growths. Neither syphilis, nor phthisis, nor any other constitutional

[1] "Med. Presse." Wien, 1874.

[2] "Deutsches Archiv für Klin. Med." 1875.

[3] "Laryngol. Mittheilungen." "Jahresbericht der Klinik für Laryngoscopie." Wien, 1875.

[4] "Deutsches Archiv für Klin. Medizin." 1876.

[5] "Traité pratique des maladies du Larynx." Paris, 1876.

[6] "Deutsche Klinik," Nos. 33—41, 1874; and "Deutsche Med. Wochenschrift," No. 34, 1876.

[7] "Die Laryngotomie zur Entfernung intra-laryngealer Neubildungen." Berlin, 1878. Whilst making use of the original work, I have also availed myself of an excellent *précis*, by Dr. Felix Semon ("Medical Examiner," May 23 and 30, 1878).

[8] "Medical Record," February 9, 1878.

"Ohio Med. and Surg. Journ." 1878.

condition, appears to favour the development of true growths, but both these dyscrasiæ—especially the tubercular—give rise to false excrescences or inflammatory out-growths. In cases of phthisis these formations, when present, occur at the posterior part of the larynx—generally on the inter-arytenoid fold. When a very protracted syphilitic congestion occurs, growths may arise; but this is a rare exception, and Dr. Harlan has well pointed out that few true laryngeal growths can be attributed to syphilis.[1] The fact, to be shortly referred to, that the affection is occasionally present at birth, makes it probable that a congenital predisposition to the disease may sometimes exist, though the neoplasm is not actually formed till adult or middle life.

Some of the exanthemata, especially variola, scarlatina, measles, and erysipelas, lead to the production of laryngeal polypi, by giving rise to chronic inflammation of the lining membrane of the larynx.

The professional use of the voice is one of the circumstances most favourable to the development of growths, 21 per cent. of my patients old enough to have an occupation having been subject to this influence.[2]

Dr. Tobold[3] remarks that the affection is most common in middle life, from the thirtieth to the sixtieth year, and that laryngeal polypi are least frequently seen in childhood. Dr. Causit,[4] on the other hand, considers that they most frequently occur in early infancy. The latter author, indeed, believes that the disease is very often congenital. But this mode of origin, though very probable in many cases,[5] has only been actually established in four, viz., one recorded by Dufours,[6] two cases in my own practice,[7] and one, the most important of all, reported by Dr. Arthur Edis.[8] In this case the child died from suffocation *thirty-seven hours after birth*, and a cyst about the size of a hazel nut was found in the larynx. According to my experience, the middle period of life would appear most

[1] "American Journal of Medical Science," vol. lii. p. 122.

[2] "Growths in the Larynx," p. 16.

[3] "Die chronischen Kehlkopfskrankheiten." Berlin, 1866, p. 200.

[4] "Etudes sur les Polypes du Larynx." Paris, 1867.

[5] Paul Bruns considers that there are at least twenty-three cases on record in which the affection was congenital. (Op. cit. p. 177.)

[6] "Archives Générales de Méd." Mars, 1867.

[7] "Trans. Path. Soc." vol. xxv. p. 35.

[8] "Trans. Obstct. Soc." vol. xviii. p. 2.

favourable to the development of these neoplasms, and I find that after the age of fifty there is a considerable and sudden diminution in their number. In 100 cases treated in my own practice, the decennium of forty to fifty furnished the greatest number of cases, whilst there were as many as seventy-two between the ages of twenty and fifty. On the other hand, there were only three patients over sixty. I have lately removed a papilloma from a woman aged seventy, in whose case the symptoms of the affection had only existed a few months; but the greatest age at which a growth has been seen occurred in the practice of Dr. Bruns, who met with a case in which the patient was seventy-four years old.

As to the causal influence of sex, of my 100 patients, 62 were males and 38 females. Of 187 patients in the practice of other operators, 135 were males, and 52 females.

*Symptoms.*—It will be readily understood, that, as a rule, the signs and symptoms of a growth in the larynx depend on the nature, on the exact situation, and on the size of the neoplasm. Thus a growth on the vocal cords causes aphonia or hoarseness; a growth on the epiglottis produces dysphagia; and a large tumour, wherever situated, is likely to give rise to dyspnœa.

The functional signs furnish very imperfect evidence, except to those who have had large experience of such cases. From the varying and peculiar character of the voice, the croupy cough, and the paroxysmal dyspnœa, the presence of a growth may be occasionally inferred by the experienced laryngologist; but those who have not met with many laryngeal polypi would be rash to form a diagnosis from such symptoms. It must not be forgotten, however, that many years before the laryngoscope was invented, both Brauers and Ehrmann[1] were able to diagnose growths with such accuracy, that they felt justified in opening the thyroid cartilage.

An alteration in the voice, though not invariably present, is the most constant symptom of a growth in the larynx. In my 100 tabulated cases, the voice was impaired ninety-two times; there being complete loss of voice in fifty-five cases, and hoarseness in thirty-seven. Impairment of voice was the only symptom in no less than 52 per cent. of my cases. As has been remarked by Czermak, a small growth often

[1] Op. cit.: Cases xv. xxix.

interferes with vocalization more than a large one; for the small neoplasm, being almost always sessile, greatly modifies the vibration of the vocal cord to which it is attached, whilst a large one often becomes pedunculated as it grows, and by rising up into the cavity of the larynx, interferes very little with the normal formation of sound. Growths on the epiglottis and ary-epiglottic folds do not generally affect the voice, unless they attain a very large size; and the same is not unfrequently true of small neoplasms on the ventricular bands. Growths below the vocal cords, on the other hand, by diminishing the column of air passing through the larynx, or by being forced up into the glottis in expiration, often cause aphonia.

Patients with laryngeal growths do not, as a rule, suffer much from cough; but this symptom is occasionally so severe as to cause very great inconvenience, and it may even give rise to hæmoptysis. The character of the cough depends upon the size and situation of the growth; it is generally dry and hacking, and often aphonic. In young children, and in adults when the growth is very large and situated in the neighbourhood of the glottis, it has often a croupy character. In seven out of the twenty-six cases noticed by Dr. Causit it was described as "croupal." I have seen it occur also in two cases in violent paroxysms.

Dyspnœa was present thirty times in my 100 cases, and was serious in fifteen cases. Difficulty of breathing occurred in about the same percentage of the cases reported by other practitioners.[1] Most of the specimens of laryngeal growths in the metropolitan museums were taken from patients who died from suffocation; and in nearly all the cases reported in the medical journals before the invention of the laryngoscope, dyspnœa was a prominent symptom. The difficulty of breathing is often paroxysmal. The explanation of this circumstance, as in many other cases of laryngeal obstruction, is, that the patient is able to breathe well, even through a narrowed windpipe, provided that no further diminution suddenly occurs. If, however, the patient takes cold, and the mucous membrane becomes a little swollen, a paroxysm of dyspnœa may supervene. In the same manner, if the respiration be hurried by exertion, an attack is likely to come on. Sometimes, also, dyspnœa occurs suddenly, from the patient getting into an unusual position, and from the growth being consequently thrown more across the glottis. In one of my cases[2] the

[1] Mackenzie: Op. cit.: Appendix D.
[2] Ibid.: Appendix A, Case 84.

patient could only sleep with the hand resting under the neck; and if by chance her head slipped away during sleep, she immediately woke with a severe attack of dyspnœa. It almost invariably happens, that inspiration is much more difficult than expiration, and Lewin [1] has remarked, that the character of the respiration has a certain diagnostic value, as regards the seat of the growth. When inspiration is noisy and stridulous, and expiration comparatively easy, the growth is probably situated above the vocal cords, and *vice versâ*.

According to my own experience, actual pain is seldom caused by growths in or about the larynx, but uneasy sensations are occasionally felt. In only one of my 100 cases [2] was there decided pain, though in another [3] there was a sensation of oppression. Though patients rarely complain of a feeling of a foreign body in the larynx, they frequently have a disposition to clear the throat, as if to expel some accumulated mucus. I have most commonly met with this symptom in cases of pendunculated growths, especially when they were attached to the vocal cords.

Difficulty of swallowing does not generally occur, except when the growth springs from the epiglottis or where it attains a very large size; it is occasionally present, however, when the neoplasm arises from the arytenoid cartilages. In my 100 cases dysphagia was only present eight times, and in every instance [4] the epiglottis was the seat of the disease. In one case only [5] was there odynphagia.

The physical signs are much more important than those of a functional character, and amongst them those observed with the laryngeal mirror stand pre-eminent. So complete is the information furnished by the laryngoscope, that were it not that there are certain rare and exceptional cases in which this instrument cannot be employed, the general semeiology would be useless. The situation of the growth can almost always be ascertained with the mirror, but in a few cases, where the growth is very large, the *exact seat of origin* may be concealed. The vocal cords are especially liable to be affected, these parts having been alone attacked in seventy-four of my cases, and suffering either alone or in conjunction

[1] "Deutsche Klinik." 1862.
[2] Mackenzie: Op. cit. Appendix A, Case 97.
[3] Ibid.: Case 90.
[4] Ibid.: Case 83.
[5] Ibid.: Case 28.

with other parts in no less than eighty-five cases. On the other hand, the arytenoid cartilages, with their folds of mucous membrane and secondary cartilages, enjoy comparative immunity.

The laryngoscopic appearance can best be described in detail, by separating the different kinds of tumours, according to their pathological nature.

*Papillomata* (Figs. 54–56) are generally sessile, though occasionally pedunculated. They are often multiple, and

FIG. 54.—PAPILLOMA IN A CHILD ÆT. EIGHT.

FIG. 55.—SOLITARY PAPILLOMA IN AN ADULT.

FIG. 56.—MULTIPLE PAPILLOMA IN AN ADULT.

sometimes occur symmetrically.[1] They vary in size from a grain of mustard to a walnut, but they do not often attain the latter dimension. Their most common size is that of a large split pea. They are generally of a pink colour, but they may be white, or even bright red.

*Fibromata* (Fig. 57) are usually round or oval, but occa-

[1] Mackenzie: Op. cit.: Appendix A, Cases 40 and 80.

sionally are of a very divided form, not unlike cauliflower excrescences.[1] They are generally, but not invariably, pedun-

Fig. 57.—Fibromata.

culated. Their surface is usually smooth, but it may be rough, irregular or wavy, and they are commonly of rather a bright red colour. They are almost always single, and vary in size from a split pea to an acorn.

*Myxomata* (Fig. 58) are very rare. In the single case[2] which I have met with, the neoplasm grew from the

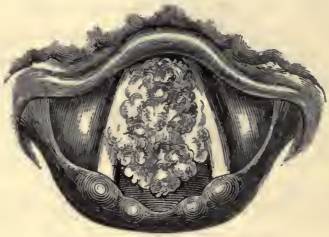

Fig. 58.—Myxoma.

right vocal cord, and was only in part of a mucous character; this portion was seen with the laryngoscope to be quite transparent, and of a bright pink colour.

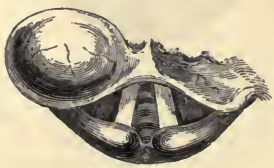

Fig. 59.—Cyst.

*Cystic Tumours* (Fig. 59) most frequently occur on the

[1] Mackenzie: Op. cit.: Appendix A, Cases 78 and 97.
[2] Ibid.: Case 99.

epiglottis, or spring from the ventricle of Morgagni. They are round, egg-like projections, and, as they usually rise to some local irritation, are themselves red, and are surrounded by a hyperæmic area.

*Angiomata* (Fig. 60).—The two growths of this kind which have come under my notice, were of a blackberry-like

Fig. 60.—Angiomata.

appearance, in colour, form, and size; one grew in the right hyoid fossa, the other from the right ventricular band. A similar growth has been observed in the former situation by Fauvel.[1]

*Lipomata.*—In the only case of lipoma on record[2] the growth was bi-lobate, of yellowish-white colour, and had a membranous pedicle, which appeared to project from the whole length of the ventricle.

By means of the laryngeal sound the density, the size, and the exact origin of a growth may often be determined, when with the laryngeal mirror alone there is still doubt as to these various points. A smooth growth may be either a fibroma or a lipoma; but whilst the former does not yield to pressure, the fatty growth is soft and resilient. The appearance of a laryngeal growth in the mirror is frequently deceptive, and it is often only by moving it with the sound, that its dimensions can be at all accurately determined. This is more especially the case, from the fact that only one surface of the tumour is visible in the mirror. Again, the insertion of a growth is sometimes hidden by the growth itself, and it is only by traction with the crotchet that the precise origin can be ascertained. The various kinds of sounds and crotchets which are useful are shown in Fig. 26. p. 243.

Examination with the index-finger is of some value in

[1] Op. cit. p. 882.
[2] Bruns: "Kehlkopfpolypen," p. 84.

those cases in which the growth is situated on the epiglottis, or the ary-epiglottic folds; but it may give fallacious results,[1] and is seldom of any practical service, where the tumour is attached at a lower level.

By pressing the larynx upwards with one hand on the thyroid cartilage, and by drawing forward the tongue with the other, the upper laryngeal orifice may occasionally be seen, and growths in this situation are thus sometimes visible. Voltolini[2] recommends that in addition to external manipulation and holding out the tongue, the fauces should be slightly irritated, so as to produce moderate retching.

On auscultation of the larynx, when the growths are at all large, moist sibilant râles may be sometimes heard, but they are only characteristic of laryngeal obstruction. When the larynx is blocked up with growths, a dull sound is elicited on percussion. Small growths, however, do not in any way modify the usual resonance. It occasionally happens, especially in papillomatous growths, that small particles are expectorated, and, on microscopical examination, their nature can be verified. When this occurs in conjunction with other symptoms, it of course furnishes general evidence as to the nature of the disease; and when there is aphonia at the same time, it may be inferred that the growth is in the neighbourhood of the vocal cords.

In the early stages, the disease is purely local; but if the growth become large, it may, by embarrassing the respiration, or through other causes, give rise to constitutional disturbance; in this way, some amount of wasting and hectic may be caused, and these cases were formerly mistaken for phthisis. Marked constitutional symptoms are, however, of exceedingly rare occurrence. The various symptoms already described generally develop themselves slowly, taking many months for their evolution. There is always a difficulty, however, in fixing upon the commencement of the disease, because the hyperæmia, which generally precedes the growth of a tumour, gives rise to the same phenomena as the neoplasm itself. The progress of the case depends, of course, in a great measure, on the pathological nature of the neoplasm. After attaining a moderate degree of intensity, the symptoms often remain stationary, and it is surprising how long

[1] "Growths in the Larynx," p. 204.
[2] "Berlin. Klin. Wochenschr." 1868, No. 23.

some patients—especially among the industrial classes—will suffer from aphonia before they seek relief. In one of my cases the patient had suffered from aphonia for twenty-four years, and another from dysphonia for twenty-three years. On the other hand, if dyspnœa or dysphagia be present, the patient is soon obliged to apply for medical aid.

As a curious fact recorded in medical literature, rather than as having any practical bearing on the course of laryngeal growths, it may be remarked, that there are a few instances[1] in which the disease has been cured by the accidental separation and expectoration of the entire neoplasm.

*Diagnosis.*—The diseased conditions which might be mistaken for growths, are those occurring in syphilis, laryngeal phthisis, elephantiasis, lupus, malignant tumours, and outgrowths. Eversion of the ventricle might also give rise to an error in diagnosis.

The *condylomata* of syphilis are seen as irregular, whitish, very slightly raised prominences on the congested membrane, the posterior wall of the larynx being their most common site. These formations are comparatively rare, and when present, generally occur from six weeks to three months after the primary inoculation; they soon disappear under the use of mineral astringents. False excrescences are the result of syphilitic ulceration and subsequent cicatrization, and occur as irregular projections in different parts of the larynx. The *gummata*, which are occasionally found in the larynx, are so evidently deposits *in* the tissues, that they are not likely to be mistaken for true laryngeal growths.

The thickening of *laryngeal phthisis* has not the defined character of a true laryngeal growth, and is generally soon followed by ulceration.

In the few cases of *lepra* that have come under my notice, in which the larynx was affected, the mucous membrane covering the epiglottis was uniformly swollen. I believe that the disease never attacks the mucous membrane until after it has shown itself on the tegumentary surface. The thickening of *lupus* is generally very much like that which occurs in tertiary syphilis, and is usually soon followed by destructive ulceration.

It is not always easy to distinguish between *benign* and *malignant* laryngeal growths; the latter, however, may be generally recognized by being more thoroughly blended

[1] Paul Bruns and Oertel: Op cit.

with the surrounding tissues, and by being very frequently ulcerated. In these cases, should particles be expectorated, or removed during life with the aid of the laryngoscope, the microscope may afford useful information.

*Outgrowths*, whether of cartilaginous, fibrous, or lymphoid character, are not likely to lead to mistaken diagnosis. It is true that the symptoms are often similar to those caused by laryngeal growths, but when the laryngoscope is used, the entire absence of demarcation between the protuberance and the normal tissues, in the case of outgrowths, is at once evident. When seen with the laryngeal mirror, they appear rather as non-inflammatory swellings or infiltrations than as defined tumours. A very characteristic case of this sort, in which the outgrowth was probably of fibrous character, is contained in my Jacksonian Prize Essay.[1]

*Eversion of the ventricle* is, perhaps, the only intelligible source of error, and this condition is extremely rare. I only know three such cases in the literature of medicine. Two[2] of these were only recognized on post-mortem examination, but in a third Dr. Lefferts,[3] of New York, at once diagnosed the disease with the mirror.

*Pathology.—Papillomata* are by far the most frequent of all the benign growths in the larynx. In my 100 tabulated cases, sixty-seven were judged to be of this character. These growths occur at an earlier period of life than the other kinds of tumours, nearly all cases found in the first decennial-period being papillomatous.

Oertel[4] and Paul Bruns[5] distinguish three varieties, which show marked differences with regard to the interval occurring between the operation and the recurrence. The first class, consisting of light-red or dark-red tumours, varying in size from a millet seed to a bean, with uneven surface and broad base, sometimes solitary, but generally thinly scattered, and never numerous, either does not recur at all, or only after some months. The second form, consisting of whitish-grey exquisitely papillary, warty, or conical tumours, nearly always originating with a broad base from the vocal cords in adult patients, also recurs very slowly, often not till

[1] MS. and Coloured Drawing in the Library of the Royal College of Surgeons.

[2] Mackenzie: Op. cit. p. 34.

[3] "New York Medical Record." June 3, 1876

[4] "Deutsches Archiv für klin. Medizin," Bd. xv. p. 290.

[5] Op. cit.

after several years. The third form consists of large reddish tumours resembling a mulberry or cauliflower. They may be solitary but are most frequently multiple, and are commonly seen in children. These growths generally recur after one or two months, and in three or four instances have been known to undergo epitheliomatous degeneration. In estimating the circumstances which govern the recurrence of papillomata, these differences, as well as the question, whether the papilloma has been *radically* extirpated, are to be considered. In several reported cases repeated recurrences took place at the primary seat of the growth, which was evidently incompletely eradicated, but ultimately a complete cure was effected by the thorough removal of the new-grown papilloma. There is also a class of cases, in which papillomata appear, after removal of the primary tumour, on other, previously healthy, parts of the larynx. These are not exactly recurrences, nor due to the operation, but simply show that even complete removal does not afford any guarantee of permanent cure, if there be a tendency to the formation of papillomatous growths.

*Fibromata* are of two kinds: (*a*) the firm and (*b*) the soft, and the former are twice as common as the latter. (*a*) Firm fibromata, though not nearly so common as papillomata, are next in order of frequency to those neoplasms. They were found to exist in 11 per cent. of my cases. The youngest patient affected was twenty-seven years of age, the oldest fifty-seven. In this class of neoplasm, the rate of growth is much slower than in the case of papillomata. Though generally situated in the submucous tissue, fibromata are supposed to grow in some cases from the perichondrium;[1] when examined microscopically, they are seen to consist of bundles of white fibres, diverging and interlacing in various directions, and generally covered with several epithelial layers. These growths show no disposition to recur. (*b*) Soft fibromata consist of more or less perfectly developed fibro-cellular tissue, and have diffused through their substance a greater or less quantity of serous-like fluid. They are comparatively rare in the larynx, being found in only 5 per cent. of my cases. The ages of the patients were 18, 21, 28, 30, and 65. In the few cases that have been seen, the rate of growth appears to have been rather slow. When removed, they have no disposition to recur. In

[1] "Handbuch der spec. pathol. Anatomie," von Dr. August Foerster. Leipzig, 1854.

each of my cases, also, there was only one growth. Trachomata (page 293), which are generally considered in connection with chronic laryngitis, are closely allied to fibromata.

*Myxomata*, or true mucous growths, are exceedingly rare in the larynx, and I have not myself met with a single instance, in which a laryngeal neoplasm was entirely of a myxomatous nature.

*Lipomata*, or fatty tumours, are rarely found in the larynx, only one case, which occurred in the practice of Professor Bruns,[1] having hitherto been published. The epithelium was of a laminated character, consisting of about fifteen layers. The membranous envelope contained two oval fatty tumours, one about the size of a filbert, the other about half that size. The neoplasm also contained a small cartilaginous growth about the size of a hemp-seed, surrounded on all sides by connective tissue.

*Cystic Tumours* are comparatively rare. Of my 100 tabulated cases, only two were of the true cystic character. Cases have also been reported by Virchow,[2] Bruns,[3] Durham,[4] Gerhardt,[5] Schroetter,[6] and Edis.[7] These growths generally spring from the epiglottis or from one of the ventricles. They generally have dense walls, and are more or less completely filled with thick, white, semi-fluid, sebaceous-like material, though sometimes the product is a thin yellowish or brown colloid fluid. Although, from our knowledge of other retention cysts, we might have anticipated that cystic tumours of the larynx would be likely to fill again, experience, so far as it goes, seems to show that when they have been thoroughly laid open, their contents emptied, and the cyst wall cauterized, there is no tendency to recurrence.

*Angiomata*, or vascular tumours, are exceedingly rare in the larynx, and there is no evidence as to the tendency to recurrence.

*Compound Growths* are not unfrequent; indeed, it is often exceedingly difficult to determine to which class of neoplasms a given growth belongs.

[1] Op. cit.
[2] "Die krankhaften Geschwülste," vol. i. p. 246.
[3] "Laryngoskopie," &c. Case xii.
[4] "Trans. Med.-Chi. Soc." vol. xlvii. 1864.
[5] Ziemssen's "Cyclopædia," vol. vii. p. 889.
[6] Op. cit.
[7] Loc. cit.

*Other kinds of Growth.—Adenomata*, or glandular tumours, are seldom met with in the larynx, though acinous gland-structure is often found in papillary growths ;[1] occasionally, however, the entire neoplasm consists of an hypertrophied racemose gland. It may perhaps be as well to remark here that hydatids are stated to have been found in the larynx.[2] Ryland[3] states, that "a case of this sort, developed in one of the ventricles of the larynx, has been known to project so far into the cavity of this organ, as to give rise to all the symptoms which usually attend a foreign body there." On this subject, Foerster observes,[4] that "*mucous polypi* were described as hydatids, by the older authors." Ryland also refers to cases of cartilaginous tumours of the larynx ; but the examination of these growths was made at a period (1835) when histology was quite in its infancy, and the account, therefore, is not of much value. Rokitansky does not mention the occurrence of cartilaginous tumours in the larynx, but Virchow,[5] limiting the term of Enchondroma to heterologous growths, and describing those cartilaginous tumours, which arise in connection with pre-existing cartilage, as Ecchondroses, especially calls attention to the occurrence of the latter in the larynx, and remarks that, "whether arising from the thyroid or cricoid cartilage, they generally grew towards the cavity of the larynx." This is not, however, invariably the case, for in a specimen which I exhibited at the Pathological Society,[6] a growth about the size of a bantam's egg, originating from the cricoid cartilage, extended downwards and forwards in front of the trachea. "The cartilaginous outgrowths," says Virchow, "are sometimes broad and flat, sometimes circumscribed and nodular. On examining the larynx (with the laryngoscope), an outgrowth of this sort, as it has an epithelial covering, is easily mistaken for a polypus, and at the present time, when laryngeal growths are studied with so much interest, these cases deserve special notice, as, from their thickness and hardness, any operation, carried out *per vias naturales* is altogether

[1] The reverse of this is stated by Drs. Cornil and Ranvier in their useful little "Manuel d'Histologie pathologique," p. 289 ; but Dr. Andrew Clark has repeatedly found portions of racemose glands in the growths I have removed.

[2] Andral : "Anat. Pathol." Translation, vol. ii. p. 459.

[3] Ryland : "Diseases of the Larynx," p. 226.

[4] Foerster : Op. cit. p. 210.

[5] Op. cit. p. 438, et seq.

[6] "Transactions of the Pathological Society," vol. xxi. p. 58.

impossible." Professor von Bruns[1] operated on two cases of laryngeal growth, in which the neoplasm was proved to consist of thyroid-gland tissue, the disease being probably allied to the so-called struma accessoria of Albers.[2]

*Degeneration of Growths.*—Laryngeal neoplasms, with the exception of some very rare forms of papillomata, which may become cancerous, exhibit little tendency to retrogressive changes. Occasionally, but most infrequently, the papillary growths undergo fatty degeneration, and probably in those few cases in which spontaneous expulsion of the neoplasm has taken place, this change had previously occurred. Caustics may perhaps, in some cases, promote these degenerative evolutions. Sometimes the neoplasms undergo amyloid degenerations, and the cases of amyloid growth reported by Dr. Ernst Burow,[3] and Ziegler,[4] probably originated in this way.

*Prognosis.*—The tendency to death being by suffocation, and the most common symptoms caused by a growth in the larynx being dysphonia, the prognosis has to be considered in relation to these two circumstances. In the few cases in which dysphagia is present, the neoplasm is generally attached to the epiglottis, and can therefore be easily removed. Under these circumstances a favourable prognosis may be given.

(*a*) *In relation to Life.*—Growths in the larynx which cannot be removed with the aid of the laryngoscope are always attended with danger to life, which is either immediate or remote, according as the neoplasm is large or small. The gravity of the prognosis is also affected by the age of the patient, the disease being, *cæteris paribus*, less dangerous in the case of adults than young children.

In *adults* death is not likely to take place from suffocation, unless the patient refuses to submit to proper treatment. Of course, if tracheotomy is performed, the peril of suffocation is at once avoided; but it must not be forgotten that, even in opening the windpipe, there is a very slight, though still an appreciable, risk. The disposition to bronchitis, which is often the immediate result of tracheotomy, when prolonged dyspnœa has prevailed, must also be taken into consideration.

In *children*, as the larynx is much smaller, the disposition

[1] Paul Bruns: Op. cit. p. 201.

[2] Virchow's "Krankhaften Geschwülste." Twenty-second Lecture, p. 13.

[3] "Laryngoscop. Atlas." Stuttgart, 1877.

[4] Virchow's "Archiv." vol. xlv. p. 1.

to spasm is much greater, and not only treatment, but even accurate diagnosis, is much more difficult. The presence of a growth also predisposes to laryngeal affections, such as catarrhal laryngitis, and possibly laryngismus, whilst in the presence of epidemic diphtheria, the child with a laryngeal neoplasm is more likely to be attacked and less likely to recover. In children also the prospect in relation to tracheotomy, both as regards the operation itself and its immediate results, is less favourable than in the case of adults. The prognosis, therefore, as regards a fatal termination, is more serious.

(*b*) *In relation to Voice.*—As regards the voice, a favourable opinion may, as a rule, be given if laryngoscopic treatment can be employed. If the fauces be not abnormally sensitive, if the upper opening of the larynx be of average size, if the growth be single, and if it be pedunculated, there is every probability that the voice will be restored. If the opposite conditions prevail, the prognosis is less favourable. When the growths are sessile, very numerous, and apparently closely incorporated with the subjacent tissues, the prospect of restoring the voice is extremely doubtful.

In giving an opinion as to the ultimate result of these cases, even when treatment is adopted with success, the disposition to recurrence must not be forgotten. In the section on Pathology, it may be seen that whilst some forms of papillomata show a continual disposition to reproduction, other laryngeal growths, with the exception of fasciculated sarcomata, seldom recur.

*Treatment.*—Before considering the subject of treatment, it may be well to observe that there are a few cases in which operative proceedure is not required. Thus small growths on the epiglottis, or ventricular bands, which cause little or no inconvenience, may well be left alone. This remark especially applies to fibromata, which grow much less quickly and are more frequently arrested in their development than other growths. In these cases, all that is necessary is to make a periodical examination of the larynx, once or twice a year, to see that the neoplasm does not increase in size. Several cases have come under my observation, during the last twenty years, in which small warts, after attaining a certain size, have not undergone any further development. Further, it sometimes happens, that the neoplasm is not sufficiently defined to admit of its removal, and in some cases, where, in consequence of the advanced age or occupation of the patient,

the voice is of little importance, no treatment need be adopted unless the respiration be also affected.

But before discussing the various kinds of treatment, it will be well to inquire whether any possible evil can result from endo-laryngeal operations. The principal points for consideration are the following:—1. Does the operation ever cause such an amount of inflammation as to necessitate tracheotomy? 2. Does perichondritis or necrosis of the cartilages ever result from these operations? 3. Does a benign growth ever become malignant under the influence of laryngoscopic operations?

1. Since I have taught laryngoscopy, many young practitioners have learnt to remove growths under my supervision, and though of course these early operations are often unsuccessful, I am not aware of a single instance in which any violent inflammation has been thus set up, or any serious injury done to the larynx. Cases, however, occasionally occur in which bad results may *appear* to follow laryngoscopic treatment. Thus a patient may present himself with a large growth nearly blocking up the glottis, but with little dyspnœa. Now it must be remembered, that such a patient is in imminent danger of death; a slight catarrh, a crumb of bread going the wrong way, or a paroxysm of coughing may choke him in a few seconds. The question thus arises in these cases whether we should perform tracheotomy at once, and subsequently remove the growths by endo-laryngeal treatment, or whether we should try the endo-laryngeal method in the first instance. It must be clearly understood that, if the endo-laryngeal operation is not successful, it is certain to precipitate tracheotomy, and that a patient who, though on the brink of suffocation, might have postponed the operation for several weeks—possibly for months—may require to have his wind-pipe opened in a few hours or even sooner. Under such circumstances the patient and his friends—possibly even the medical attendant if he has not carefully studied the peculiar contingencies of the case—may suppose that the rashness of the operator has necessitated an extra-laryngeal operation which would not otherwise have been called for. On the other hand, if the operator had at once proclaimed the necessity of tracheotomy, he would have been free from blame in the minds of those looking on. Nevertheless the duty of the laryngoscopist, under the circumstances referred to, is clearly to try the endo-laryngeal method in the first instance, after fully explaining the situation to the patient. I can recall many instances, in my own practice, in which tracheotomy has thus been altogether avoided—cases, indeed, in which I scarcely supposed it possible to operate without being obliged to open the windpipe precipitately. In three instances, however, of large growths, in which endo-laryngeal methods were attempted, I found it necessary to perform tracheotomy a few hours—in one instance two hours—later.

2. As regards the development of perichondritis, I am not aware of any instance in which this condition has resulted from an endo-laryngeal operation. In one of my cases,[1] in which the *left vocal cord was immobile before the growth was touched*, on the removal of the growth *from the anterior commissure* of the vocal cords, the abductive action of the left cord was seen to be defective, and four months later tracheotomy became

[1] Op. cit.: Case 73.

necessary. After wearing the tube for eighteen months the patient died. On post-mortem examination the *posterior plate of the posterior wall of the cricoid cartilage* was found to be diseased, and there was a fistulous communication at the base of the cartilage between the food and air passages. The history of this case points to the probable origin of the disease in the cricoid cartilage at a date antecedent to any laryngoscopic treatment; and I would call attention to the fact that the part operated on—the anterior commissure of the larynx—was *within* the larynx, whilst the necrosed cartilage may almost be said to have been *without* that organ, and nearly an inch from the seat of the growth.

3. As regards the question of the conversion of benign into malignant growths, I may mention that in my first series of growths there was one case [1] which at first was believed to be papillomatous, but subsequently proved to be an epithelioma. In this case, the full details of which will be found in my work, the patient's throat was so irritable that only three laryngoscopic *séances* were attempted, and I only once succeeded in passing forceps into the larynx. As the whole growth was subsequently removed by thyrotomy, I cannot imagine that the single endo-laryngeal operation could have converted a benign into a malignant growth. The whole subject has recently been so ably discussed by another physician [2] that I cannot do better than make use of his observations. Whilst allowing that benign growths sometimes assume a malignant character in the entire absence of surgical interference, the writer calls attention in this respect to Virchow's [3] opinions, who admits that persistent irritation of *healthy* tissues may lead to the formation of heteroplastic growths. The author justly maintains, moreover, that the degeneration of benign into malignant neoplasms never takes place except when there is an inclination to constitutional vice; and he points out that under these circumstances the change may take place, with or without surgical interference. He further remarks that even frequently repeated local irritation does not produce degeneration. This has been most noticeable in those cases in which, in consequence of repeated recurrences, laryngoscopic treatment has had to be recommenced *de novo* many times, sometimes even on four, five, or six occasions, until finally a complete cure was obtained.

In some cases of growth, especially in recurrent papillomata, I have operated from time to time for many years without ever observing any malignant degeneration. Indeed, in the many hundred cases of papillomata that have been operated on, I only know of three instances (Gibb, Mackenzie, and Rumbold) in which growths originally benign afterwards assumed a malignant character. I am not aware that there is the slightest evidence that in any one case treatment exercised an unfavourable influence.

Were, however, the conclusions on the above points of quite an opposite character, the symptoms are often so inconvenient and sometimes so dangerous, that in by far the greater number of cases that come under notice, it would still be necessary to adopt measures for the removal of the growth, or for the relief of the symptoms it causes. These measures may be either palliative or radical.

[1] Op. cit.: Case 87, p. 183.
[2] "London Medical Record," November 15, 1878, p. 495. (The article i question is anonymous, but I believe that the author is Dr. Felix Semon.)
[3] "Die krankhaften Geschwülste," Bd. i. p. 349.

*Palliative treatment* consists in placing the patient in such a condition as to relieve him of immediate danger to life. This plan of treatment is called for in all cases, where the growth greatly interferes with respiration, where for any reason laryngoscopic treatment cannot be carried out, and where the patient is unwilling to permit an extra-laryngeal operation. The only safe palliative treatment consists, of course, in the operation of tracheotomy, and it must be recollected, that this operation affords absolute protection only as regards death from suffocation. When growths situated in the cavity of the larynx attain a very large size, they are apt after a time to interfere with deglutition. In such cases, therefore, though tracheotomy may have removed the original source of danger, at a later stage progressive dysphagia may occur.

*Radical treatment* may be conducted either *internally*, through the natural upper orifice of the larynx, that is, with the aid of the laryngoscope; or *externally*, or by direct incision into the larynx; or by the *combined method*, tracheotomy being first performed, to place the patient in a condition of safety, and the growth being subsequently removed through the mouth.

*The Removal of Growths by Endo-laryngeal Treatment.*—This method represents, perhaps, the greatest triumph which the laryngoscope has effected. No danger is incurred, little or no pain is felt, and scarcely a drop of blood is lost, whilst the long lost function of a most delicate organ may be almost instantly restored, and a morbid condition, threatening the immediate extinction of life, may be at once and for ever removed.

The removal of growths from the larynx requires ingenuity on the part of the operator in overcoming difficulties by means of mechanical contrivances, but above all, perhaps, the intelligent co-operation of the patient. Although greater *éclat* is often derived from the removal of a large growth than a small one, it will be readily understood, that, *cæteris paribus*, the smaller the growth the greater the difficulty of its removal. As a rule, a growth of moderate dimensions—that is, one between the size of a horse-bean and a Barcelona nut—is most easily seized. Of course, the difficulty partly depends on situation, the posterior portion of the glottis being more accessible than the anterior, and the upper part of the larynx than the lower. The difficulty is immensely increased when the growth is situated below the vocal cords.

*Several different kinds of Instruments*, and indeed different modes of treatment, are often required in the same case. It is obvious that certain kinds of instruments are better adapted for certain kinds of growths: thus the short sessile growths —the most common in the larynx—can be most easily removed with forceps; cystic tumours only require incision, and small fibromata may frequently be treated by division of their base. On the other hand, pedunculated growths are favourable to the use of wire-loops, écraseurs, and guillotines.

*Endo-laryngeal treatment* may be either mechanical or chemical, and though in practice it is sometimes necessary to combine these methods, it will be found most convenient to consider them separately.

*Mechanical treatment* may be accomplished, (1) by *evulsion;* (2) by *crushing;* and, (3) by *cutting.* I have not thought it necessary to subdivide the last-named process into excision, abscission, and incision, as it would lead to useless repetition.

Before commencing treatment, some previous preparation is required in many cases. Congestion of the fauces, elongation of the uvula, enlarged tonsils, and hyperæmia of the larynx, must, if possible, be first subdued by appropriate remedies. Unless the congestion of the larynx be very considerable, it need not be taken into account, but if there be active inflammation, any operative procedure would be likely to aggravate the mischief, and render tracheotomy necessary. It is also quite useless to attempt any delicate operation on the larynx while the uvula is greatly elongated or the tonsils much enlarged.

In order to facilitate endo-laryngeal operations, various procedures have been recommended for producing anæsthesia of the pharynx and larynx. It is unnecessary, however, to describe the various means recommended, such as the application of chloroform, morphia, &c., to the internal parts, the administration of opiates, bromide of potassium, &c., as I have never found any of them of the least use, and some are even dangerous in their effects.

Patients cannot, as a rule, be operated on *under chloroform*, unless tracheotomy has been previously performed, or unless the growth is within reach of the finger, or external to the larynx, viz., in the hyoid fossa or on the posterior surface of the cricoid cartilage. By inhaling a few whiffs of chloroform, however, before treatment is commenced, the larynx is sometimes rendered less sensitive. By sucking ice, also, for

a few minutes before the operation, laryngoscopic treatment is more easily borne.

When the epiglottis is long and hangs obliquely, it sometimes hinders operations on the larynx, and several instruments have been invented for raising it. Some Continental practitioners even go so far as to pass a thread through the valve, and cause it to be held back by an assistant during the operation. Though such instruments may be useful for purposes of diagnosis, I have not found them applicable where operations have been necessary.

Before introducing instruments into the larynx, they should always be warmed. This precaution should never be omitted, as it greatly diminishes the irritation naturally caused by the use of instruments in the larynx.

As no practitioner would attempt to remove growths without being thoroughly skilled in the use of the laryngoscope and in the application of remedies to the larynx, it is unnecessary to enter into minute details as to the precise mode of carrying out the operation, I may, however, observe, that as, when an assistant holds out the patient's tongue, his hand and arm are apt to get in the way, and the tongue is likely to be drawn to one side, the patient should hold out his tongue himself. In the same way, if it can be avoided, I do not employ an assistant to steady the head; for this purpose, all that is required is a chair with a high perpendicular back and narrow seat.

(1.) *Evulsion* is effected with forceps, and is applicable to all growths, except those of cystic character. Cysts have indeed been torn away; but this is only possible where the walls are thin and membranous. This method is particularly suitable in cases of sessile growths, for here other modes of treatment are difficult, and the softer the growth, the more favourable it is for removal by evulsion. I am in the habit of removing growths with two kinds of forceps, viz., the common laryngeal forceps and the tube-forceps.

(2.) *Crushing* can be carried out with either of the two kinds of forceps already described, and was used, in conjunction with other methods, in 3 of my 100 cases; it has also been employed by Lindwurm, Schroetter, Türck, and others. I formerly employed this plan of treatment in cases in which the growth was of dense structure, and very firmly attached; but latterly I have generally used cutting instruments in these cases. Crushing, however, is preferable to using force in evulsion. As a rule, the stronger kind of

forceps are required; but the blades should be flatter, *i.e.* less spoon-shaped, and rougher, than for evulsion. The American translator of Dr. Tobold's work describes the process as "crushing up," and observes, that energetic and repeated compression of the tissue is all that is required, to destroy the conditions of nutrition and produce mortification, and that subsequently the dead portion can be separated. It is probable that, in many cases, where evulsion is adopted, crushing takes place at the same time; in other words, that, when a growth is torn away, its base is, to a greater or less extent, lacerated and crushed. The success of evulsion must, therefore, in part, be attributed to the incidental crushing which takes place.

(3.) *Cutting* may be carried out, as already remarked, either by excision, abscission, or incision. For excision, cutting forceps are used; abscission may be performed by means of knives, scissors, guillotines, or écraseurs; while for incision, or scarification, knives or lancets are employed.

I now remove almost all growths with my cutting forceps and rarely make use of knives, scissors, or other instruments. Only very small guillotines can be used, and only a very small portion of a growth can, as a rule, be sliced off. I have never been able to employ these instruments with advantage.

Voltolini[1] has pointed out that soft pedunculated growths may be torn away by frequent up-and-down movements of a sponge passed into the larynx. Some years ago I removed a growth from the larynx of a child (on whom I was unable to use the mirror to guide the hand) with a miniature *ramoneur* (see Œsophageal Instruments). In such cases I think my croup-brush (p. 244) might prove useful.

*Chemical Treatment.*—Chemical treatment may be carried out either with caustics, escharotics, or galvanic cautery.

*Caustics.*—Solutions of nitrate of silver are generally of but little use; if employed, however, they should be exceedingly concentrated, and should be accurately applied, with a very fine camel's hair pencil, to the seat of disease. On reference to my own cases,[2] but especially to those treated by other practitioners,[3] it will be seen that when laryngoscopy was first introduced, growths were generally treated by the application of caustics. This was no doubt

[1] "Monatsschrift für Ohrenheilkunde," &c. No. 2, 1877. See also Nos. 3 and 8, 1878, and No. 1, 1879.

[2] Op. cit.: Appendices A and C. [3] Ibid.: Appendix D.

due to the circumstance that practitioners were not then yet aware to how great an extent operations could be conducted within the larynx, and at that time, of course, no great manual dexterity in this department had been acquired. The small utility of this treatment is, however, demonstrated by the fact that since 1862 mechanical methods have almost entirely superseded the local application of caustics. Nevertheless, there are some cases in which caustics can be usefully employed. Thus in treating cystic growths, it is a good plan to apply caustic to the interior, after an incision has been made, and the contents of the cyst evacuated.

Again, for the prevention of recurrence after the removal of papillary growths, Fauvel [1] recommends the insufflation of a powder consisting of equal parts of savine and alum.

*Escharotics.*—On a few occasions I have employed escharotics with marked success, but only in a supplementary way. They may be used in cases where numerous small growths cover a large surface of the mucous membrane of the larynx.[2] I have occasionally employed nitric acid, but the escharotic which I have found most useful is "London paste" (Throat Hosp. Phar.). To all caustics and escharotics, however, the objection remains, that if sufficiently powerful to be effective, they are very likely to cause spasm of the glottis, or to give rise to inflammation of the adjacent mucous membrane; for this reason I now very seldom use them.

*Galvanic Cautery.*—Galvanic cautery may be carried out, either with knife-like instruments, or with loops. This plan of treatment was first practised by Professor Middeldorpf,[3] and has since been very successfully carried out by Dr. Voltolini,[4] of Breslau, and other practitioners; but I cannot say that I have found it well adapted for the destruction of laryngeal growths.

*Extra-Laryngeal Methods of Removing Growths.*—In certain cases, it unfortunately happens that growths in the larynx cannot be removed through the mouth.

The difficulty of laryngoscopic treatment may be due to the large size or extreme density of a growth, to its inaccessible situation, or extensive origin; to the occurrence of inflammatory tumefaction, or spasm of the glottis, on attempted evulsion through the mouth; to great irritability of the fauces, or to an unusually nervous and excitable state

[1] Op. cit. p. 256.
[2] Mackenzie: Ibid.: Appendix A, Case 3.
[3] Op. cit. [4] Op. cit.

of the patient. In the case of very young children also, an extra-laryngeal method may be necessary.

The large size of a growth does not, in itself, call for external treatment, some of the largest growths having been removed *per vias naturales*.[1] The extreme density of a growth sometimes presents a great difficulty to laryngoscopic treatment, but with strong cutting forceps, this difficulty is only insuperable in the case of ecchondroses, and it is very questionable whether radical treatment should be attempted for their removal. The growth may be so situated that it cannot be completely eradicated from above. This occasionally happens in the case of growths springing from the anterior wall of the larynx below the vocal cords. In one of my cases of this sort, the evulsion was incomplete,[2] but in two others the tumour was entirely eradicated. When a growth, however, is situated in the ventricle, and only slightly projects from the ventricular orifice, it is sometimes impossible to remove it entirely from above. The projecting portion may be cut off, but the base remains.

The occurrence of inflammation or spasm of the glottis, on attempted laryngoscopic treatment, may render the *combined method* necessary (tracheotomy having first been performed, and evulsion being subsequently effected through the fauces), but it does not in itself justify an extra-laryngeal operation for evulsion.

An insuperable irritability of the fauces, or an extremely nervous condition of the patient, may, however, render laryngoscopic treatment impossible; and in these cases an extra-laryngeal treatment may be necessary. In the case of young children who cannot be taught to submit to laryngoscopic treatment, extra-laryngeal treatment may be required; but it must not be forgotten that very young children have been successfully treated with the aid of the laryngeal mirror.

*Contra-Indications for extra-Laryngeal Methods.*—It may be stated as a cardinal law, that *an extra-laryngeal method ought never to be adopted* (even where laryngoscopic treatment cannot be pursued) *unless there be danger to life from suffocation or dysphagia*. Direct incision into any part of the air-passages is always attended with both immediate and remote danger to life, the amount of risk, however, not being great, as a rule. Dysphonia does not justify operations, which,

[1] Mackenzie: Op. cit.: Appendices A and C, Cases 3, 52, 92, 95, &c.
[2] Ibid.: Appendices A and C, Case 24.

though easy to perform, may be regarded as "capital." Hence an extra-laryngeal operation is not justifiable for the removal of a *small* growth in the larynx, unless that growth give rise to dangerous dyspnœa, and cannot be removed by a less serious method.

Contra-indications based on danger to life, having been thus briefly pointed out, it only remains for me to remark that destruction of the vocal function is often the result of any extra-laryngeal method.

Extra-laryngeal methods of extirpation may be carried out in one of three ways:—1st, By division of the thyroid cartilage, or thyrotomy; 2ndly, by supra-thyroid laryngotomy, or division of the thyro-hyoid membrane; and 3rdly, by infra-thyroid laryngotomy (through the crico-thyroid membrane), or tracheotomy.

*Division of the Thyroid Cartilage, or Thyrotomy.*—*History.*—This important operation was first proposed for the removal of laryngeal growths by Desault, at the end of the eighteenth century. His remarks, which were perfectly true before the invention of the laryngoscope, are as follows:—"In cases of polypi of the larynx, the indications are two-fold; viz., the extirpation, or ligature of the growth, and the re-establishment of a passage for air; and they both necessitate laryngotomy. It rarely happens, indeed, that laryngeal excrescences project so far into the mouth, that they can be seized and extirpated or ligatured *per vias naturales*."[1] The operation was not, however, carried out till the year 1833, when it was performed for the first time by Brauers of Louvain. Ten years later it was repeated by Ehrmann of Strasbourg. In 1851 it was practised by Gurdon Buck, and again by the same surgeon in the year 1861. The invention of the laryngoscope naturally gave an impetus to this operation.

*Indications for Operation.*—This operation may be required for the removal of large growths in the cavity of the larynx, which cause great dyspnœa or dysphagia, and cannot be removed with the aid of the laryngoscope; or for the evulsion of growths in the sub-glottic region, which cannot be extirpated by indirect laryngotomy (through the crico-thyroid membrane). It might be thought that this operation would be called for in the case of children; but the facility with which even very young children can be treated laryngoscopi-

[1] This quotation is taken from a later edition of Desault's "Œuvres chirurgicales," by Bichat. Paris, 1812, vol. ii. p. 255.

cally has already been pointed out; and it must not be forgotten that when the larynx is small, thyrotomy is much more likely to lead to injury of the vocal cords.

Dr. Paul Bruns has successfully refuted the assertion that either the very large size, extremely hard consistence, unusually broad insertion, unfavourable situation, or multiplicity of the neoplasms, is, *a priori*, sufficient to contra-indicate a trial of the endo-laryngeal method. "It is only in certain rare exceptional cases," Paul Bruns observes, "*in which several of these unfavourable conditions occur together*, that we are entitled *a priori* to consider the attempt at removal *per vias naturales* as having no favourable prospect, *e.g.*, in some cases of solid tumours with very broad bases situated below the glottis or originating in the ventricles." Here he shows, that out of 1,100 neoplasms, there were 602 papillomata, and 346 fibromata (constituting together 86 per cent. of all these growths); further, that 836 out of these growths originated from the vocal cords, while only $\frac{3}{8}$ths per cent. were situated below the glottis or in the ventricles. Consequently it is proved that three-fourths of all laryngeal growths are of such a nature and so situated, that they are well suited for endo-laryngeal interference. Whilst proving further by a good many examples, that growths springing from the under surface of the vocal cords, and those originating within the ventricles, have been and may easily be extirpated through the mouth if they are pedunculated, he, nevertheless, admits that *subcordal* or *ventricular* neoplasms, which have no pedicle, or are seated on a very broad base, or show an inclination to recurrence, belong to the department of laryngotomy. For the removal of subcordal growths, however, he recommends partial laryngotomy (cricotomy or crico-tracheotomy with preservation of the thyroid cartilage), and only sanctions thyrotomy for the extirpation of tumours originating within the ventricles.

*Method of Procedure.*—The first question which arises is whether tracheotomy should or should not be performed as a preliminary measure of safety. I agree with Paul Bruns, "that previous or simultaneous tracheotomy, although it has been performed in by far the greater majority of the cases, is not required by the nature of the operation, unless there be other conditions necessitating its performance, such as dyspnœa." If tracheotomy is first performed, thyrotomy should not be at once carried out, but endo-laryngeal treat-

ment should be carefully attempted when the tracheal canula has been worn for a few weeks. This failing, the surgeon may have recourse to the more severe treatment.

The incision for thyrotomy should be made exactly in the median line, through the textures over the thyroid cartilage, from the thyroid notch to the upper border of the cricoid cartilage. The thyroid cartilage should then be most carefully divided by a succession of small nicks, with a short, strong, sharp-pointed knife; but if ossification has taken place, the opening must be effected with a small circular or convex saw. If possible, the upper extremity of the projecting angle of the thyroid cartilage (pomum Adami) should be left intact, as the complete division of the cartilage in this situation is likely to be followed by changes in the relations of the vocal cords to one another, resulting in permanent aphonia. The instrument should not be allowed to penetrate the larynx until the whole of the cartilage is divided.[1] By this method the paroxysms of coughing, which otherwise interfere with the operation, are often avoided. When divided, the alæ of the cartilage should be kept widely apart by means of strong retractors held by two assistants, one on each side of the patient. The retractors should be like miniature pitchforks, with the points blunted and bent round, so that they can hold back the alæ.

If the alæ cannot be thrown back, the crico-thyroid membrane should be divided along the lower edge of the thyroid cartilage, on one side, or, if necessary, on both sides. If there be still insufficient room, the thyro-hyoid membrane should be divided, by a horizontal incision along the upper edge of the thyroid cartilage. Horizontal division of the membranes, however, is not generally necessary, and the thyro-hyoid should if possible be left intact.

The operator should now throw a strong reflected light into the opening, and, guided by it, and his previous laryngoscopic knowledge of the case, he will be able to seize the growth with a hook or forceps, and divide it with a pair of short curved scissors. On account of the small space at the command of the operator, the growth may sometimes be cut through with a knife, without being previously seized, or it may be torn away with forceps. Sometimes, however, even after total division of the thyroid cartilage, the extensive attachments or dense consistence of the growth prevents

[1] This precaution is justly insisted on by Krishaber and Planchon ("Faits cliniques de Laryngotomie." Paris, 1869, p. 93).

its removal,[1] and the surgeon is obliged to desist from the operation. If all goes well, after the growth has been excised, its base should be firmly touched with solid nitrate of silver. Actual cautery, acid nitrate of mercury, and galvanic cautery, have all been used, but I prefer the nitrate of silver, as less likely to give rise to laryngitis, and quite as effectual when applied to a raw surface.

The two alæ of the thyroid cartilage should then be carefully brought together, in their exact normal situation, with two silver sutures, and the edges of the wound united with plaster. The canula should be allowed to remain in the trachea, for, at least, a few days, until all danger has passed off; or if there be any likelihood of recurrence, till further steps have been taken to effect complete eradication.

In some cases the cricoid cartilage has been divided, and though no harm appears to have resulted from its section, it is better, if possible, to leave it intact. Krishaber[2] justly remarks that division of the cricoid cartilage is altogether *unnecessary;* for whilst, on the one hand, it does not facilitate the removal of growths above the vocal cords, those below the glottis can easily be removed through an opening either in the crico-thyroid membrane or in the trachea.

*Comparative Merits of Thyrotomy.*—Unlike the operation conducted *per vias naturales*, the procedure now under consideration is a very serious one, both as regards the danger to life and the risk of destruction of function.

In 1873[3] I published some articles on the results of thyrotomy, based on forty-eight cases, which comprised all then published. The following is a brief summary reduced to percentages, and placed in a tabular form :—

| | Per cent. on 48 cases. |
|---|---|
| Complete success[4] .. .. .. .. | 14·58 |
| Partial success .. .. .. .. .. | 22·91 |
| Death .. .. .. .. .. .. | 8·33 |
| Severe dyspnœa requiring use of canula .. | 31·25 |
| Severe dyspnœa requiring fresh operation .. | 8·33 |

I have also tabulated the following other results, which

[1] Paul Bruns: Op. cit. p. 167.

[2] Op. cit.

[3] "Brit. Med. Journ." May, 1873.

[4] Complete success is understood by me to mean recovery of perfect voice and perfect respiration, and absence of recurrence of growth; partial success to mean recovery of one function with injury to another, or temporary recovery of both functions, but subsequent recurrence of the growth.

are based on thirty-nine cases of *benign growth*, in which, the voice being affected before the operation, the patient survived more than a few days :—

| | |
|---|---|
| Aphonia .. .. .. .. .. | 40·0 per cent. |
| Dysphonia .. .. .. .. .. | 20·0 ,, |
| Modified voice .. .. .. .. | 11.11 ,, |
| Not stated, but probably defective voice | 6·66 ,, |
| Recurrence, or incomplete removal .. | 38·46 ,, |

The following are some of the conclusions which I arrived at :—

(*a.*) That the operation ought never to be performed for loss of voice alone.

(*b.*) That the operation should be confined to those cases in which there is danger to life from suffocation or dysphagia, and even then should only be performed after an experienced laryngoscopist has pronounced it impossible to remove the growth *per vias naturales*. Dr. Paul Bruns[1] in his valuable work on the relative merits of thyrotomy and endo-laryngeal operations for the removal of growths, remarks : "I quite agree with Mackenzie that 'laryngotomy is only justifiable when an experienced laryngoscopist *has declared the removal of the growth per vias naturales impossible*' ("Brit. Med. Jour.," May 3, 1873, p. 488)—'only, I should say, *after he* (an experienced laryngologist) *has attempted the removal in vain*."

In order to thoroughly weigh the merits of thyrotomy, it is necessary to consider the prospects of the operation : (1), in relation to the preservation of life ; (2), in relation to the recovery of voice ; and (3), in relation to the immunity from recurrence. Each of these points will now be discussed in detail.

(1.) *In Relation to Life.*—In division of the laryngeal cartilages there is always some immediate danger. One patient died from secondary hæmorrhage a few days after the operation, and several others have rapidly succumbed to pleurisy, pneumonia, or metastatic abscess of the lungs. In Dr. Cutter's case the patient was almost suffocated during the operation ; and in one of Navratil's earlier cases, the hæmorrhage was alarming, and the patient nearly died from the quantity of blood which passed down the trachea. In another of that surgeon's cases the patient suffered from high fever, and expectorated a quantity of blood and pus : œdema took place

[1] Op. cit.

round the wound, and the patient was in a very critical state.

The usual risks attending the ordinary operations for opening the air-passages, are also, of course, present, and tracheitis or bronchitis may supervene. In addition to the immediate danger, there is also the contingent risk of chronic perichondritis at a later period.

(2.) *In Relation to Voice.*—In discussing this question, Bruns shows that the operation is very fatal to the vocal function. He takes exception to my statistics[1] on the ground that I have estimated the functional result *together with* that of the operation, in a general way, without stating whether the whole growth was removed, or whether recurrence took place or not—a method which naturally yields untrustworthy results. Bruns, therefore, carefully excludes from his statistics all those cases of final alteration or loss of voice in which this change could possibly be attributed to any other cause than the operation itself. Thus, out of the ninety-seven cases on record, thirty-eight only can be used for the decision of the question, whether the operation is, in itself, dangerous to the vocal function. Of the reality of this danger there can, however, be no doubt, for in 47 per cent. only (eighteen cases) out of these thirty-eight cases, was a normal or nearly normal voice restored or retained, while in twenty cases, the voice was either completely lost (six cases), or reduced to nearly complete aphonia or extreme hoarseness (fourteen cases). We see, therefore, that in the majority of cases, the operation itself brings the vocal function into great danger.

(3.) *In Relation to Recurrence of Growth.*—It might be expected that extirpation could be more completely effected when the thyroid cartilage is divided, and the larynx thoroughly exposed to view, and that thus recurrence would be less frequent; but this supposition is not borne out by facts.

Dr. Paul Bruns has well pointed out, that the question of recurrence must be decided upon an examination of the cases of papilloma only: for fibromata do not recur, and the number of sarcomata operated on hitherto, is too small to permit of any satisfactory conclusion. Further, only those cases can be made use of which were under observation for a considerable time after the operation. Of Dr. Bruns' cases, one was only observed for five weeks, but most of them were kept in view for many months and even years. Distinctions of age must also be taken into account, children being separated for comparison from adults.

[1] "British Medical Journal," 1873, p. 488.

*In the case of children* Bruns[1] has collected seventeen instances of *thyrotomy*. Of these there were eight cures and nine recurrences. Out of forty cases treated by the *endo-laryngeal* method, twenty-six only were available. Among these we find thirteen cures and thirteen recurrences, but the latter number includes seven cases in which the growth had not been entirely removed, and which therefore do not properly belong to the category of recurrence. It must be admitted, however, that the cases of thyrotomy had *a priori* worse prospects than the others, the operation having been performed almost without exception in cases of *multiple papilloma*, and in the overwhelming majority of cases on children *under ten years*, while these unfavourable conditions were both present in only one-half of the cases treated *per vias naturales*.

*In adults* there were twenty-two cases of thyrotomy, with ten cures and twelve recurrences. Seventeen were cases of multiple, and five of solitary, papilloma. In the latter class recurrence took place only once, but in the former eleven times. With regard to the endo-laryngeal operation, on the other hand, after taking the above-mentioned precautions, there are only sixty-four cases, out of the great number on record, which can be used for these statistics. These sixty-four cases show forty-seven cures and seventeen recurrences. In thirty-one cases the papilloma was solitary (twenty-four cures and seven recurrences); in thirty-three multiple and diffuse (twenty-three cures and ten recurrences). Six of these cases were only cured after *repeated* operations.

These statistical tables show, therefore, that the frequency of recurrence after either method in adults and children together is as follows: (1) Thyrotomy, thirty-nine cases, eighteen cures, twenty-one recurrences; (2) Endo-laryngeal method, ninety cases, sixty cures, thirty recurrences, or, in other words, *whilst thyrotomy gives a few more recurrences than cures, the endo-laryngeal method shows twice as many cures as recurrences*. These numbers thoroughly refute the unfounded assertions of the partisans of thyrotomy.

The following is an abstract of Paul Bruns' conclusions on the more important matters:—

(A.) Thyrotomy is not dangerous to life, nor difficult to perform, but it is, in itself, very dangerous to the vocal function. The pretended advantages as to the facility of its performance, the certainty of complete extirpation, and the security against recurrence do not exist in reality.

(B.) Thyrotomy can therefore in no wise be placed on a par with the endo-laryngeal method, and is to be performed only, if an experienced laryngoscopist has unsuccessfully attempted the endo-laryngeal operation.

(C.) Even in this case thyrotomy should not be performed if it can possibly be avoided, but partial laryngotomy (division of the crico-thyroid ligament, and, if necessary, of the cricoid cartilage and the superior tracheal rings), inasmuch as everything depends (so far as the restoration of function is concerned) on the question, whether the operation can be performed without the division of the thyroid cartilage (*i.e.*, the anterior commissure of the vocal cords).

[1] Op. cit. p. 147, et seq.

(D.) In urgent cases, in which tracheotomy has to be performed for the relief of dyspnœa, thyrotomy should never be undertaken until removal by the endo-laryngeal method has been first attempted; and in these cases success may often be obtained by "partial" laryngotomy, the tracheal incision being prolonged through the cricoid cartilage.

(E.) If after endo-laryngeal removal of papillomata recurrence takes place, the same method ought to be tried over and over again, as there are many cases on record, showing that after frequently-repeated operations complete cure was finally obtained.

On the subject of thyrotomy Dr. Fauvel[1] remarks, "I am extremely astonished to see surgeons, and still more so specialists in laryngoscopy, when they have only to deal with a simple polypus not menacing the life of the patient, still having recourse to this barbarous method, which consists in making an opening in the neck for extracting, by this dangerous, and often, too narrow way, tumours of a greater or less volume and consistence. The laryngoscope shows the polyp as plainly as possible; and also its seat, form, and size. It is therefore useless, not to speak more strongly, to establish, at the cost of a severe and bloody operation, an artificial opening into the larynx. This opening has no other result, I repeat, than to expose the polyp and permit an operation—two conditions which are completely fulfilled by the laryngoscope." He further proceeds to point out the danger of the operation from hæmorrhage, and remarks that "in one case of thyrotomy, *he was obliged to apply thirty-eight ligatures*, though tracheotomy had been performed a month previously, and the patient wore the canula during the time the thyrotomy was being undertaken."

*Removal of Growths by Division of the Thyro-Hyoid Membrane, or Supra-Thyroid Laryngotomy.*—This method of treatment is indicated for the removal of large growths situated at the upper orifice of the larynx, which cannot be taken away *per vias naturales*.

The operation, originally proposed at about the same time by Malgaigne[2] and by Vidal de Cassis,[3] was first carried out in the year 1859. The operator was Dr. Prat, a surgeon in the French navy, stationed at that time at Papiete, the capital of Otaheite. The patient, who was the subject of advanced pulmonary phthisis, suffered also from such extreme difficulty of swallowing, that he could scarcely take any food. The dysphagia was due to a growth, which appears to have been situated on the under-surface of the epiglottis; it could be felt with the finger, but all attempts to seize and remove it through the mouth entirely failed. By operating after the manner recommended by Malgaigne, Dr. Prat easily removed the growth, which was of a compact fibrous structure and

[1] Op. cit. pp. 227 and 229.

[2] The claim to originality is made by Malgaigne in his "Manuel de Médecine opératoire." Paris, 1871, 7me édition, p. 525.

[3] Velpeau: "Médecine opérat."

greyish-white colour. No vessels were tied. The wound healed quickly, and the symptoms from which the patient had suffered disappeared. He died shortly afterwards from phthisis, and at the autopsy no trace of the growth was to be found.[1] In the year 1863 Follin[2] performed a similar operation with complete success. The neoplasms were extirpated, and the patient was entirely cured.

Transverse incision through the thyro-hyoid membrane should, according to Malgaigne, be made along the lower border of, and parallel with, the hyoid bone, through the skin, superficial fascia, the inner half of the sterno-hyoid muscles, the thyro-hyoid membrane, and the mucous membrane which extends between the base of the tongue and the epiglottis, and forms the glosso-epiglottic ligament. The side of the epiglottis should then be seized and drawn through the wound. The growth can then be removed, according to the circumstances of the case, by bistoury, scissors, or forceps. It may be stated that Follin divided the thyro-hyoid membrane along the upper border of the thyroid cartilage, that is, rather lower down than advised by Malgaigne, with a view of avoiding the epiglottis; and as far as I can gather from the report of his case, the incision was carried further outwards than in Prat's case. The latter procedure certainly renders the epiglottis less likely to be wounded, but little immunity is afforded to the valve by making the incision a few centimetres lower down than recommended by Malgaigne. It must also be remembered that the more external the incision is carried, the greater is the danger of wounding important vessels. In any case, the hyoid branch of the thyroid artery is not unlikely to be wounded, but this is not a matter of any importance.

Although sub-hyoid laryngotomy is unattended with any considerable danger, either immediate or remote, I do not think that it will find much favour with those skilled in operating with the aid of the laryngeal mirror; for it happens that those cases which are favourable to the performance of this operation are just those which, as a rule, can be most easily treated through the mouth.

The operation is much less serious than thyrotomy, in relation to life, and is not attended with any risk to the vocal function. In operations involving the cartilages which form the framework of the larynx, there is, as has been already pointed

[1] "Gazette des Hôpitaux." 1859, No. 103, p. 809.
[2] "Archives Générales de Médecine." Février, 1867.

out, always the danger of subsequent caries; but it is well known that injury of the elastic cartilages, though it may cause temporary inconvenience, is unattended with permanent risk. Not only do we frequently find that patients, recovered from tertiary syphilis, with the mere stump of an epiglottis, can swallow perfectly well; but it has already been proved, in the celebrated case of Prince Murat,[1] that the epiglottis may be suddenly cut away with only temporary inconvenience. Again, most hospital surgeons must have frequently met with extensive suicidal wounds of the thyro-hyoid membrane involving the epiglottis, which have healed rapidly without any bad results. This last fact has been illustrated by some remarkable cases by Künst.[2]

*Removal of Growths by Infra-Thyroid Laryngotomy (through the Crico-Thyroid Membrane), or by Tracheotomy.*—This mode of eradicating growths was recommended by Professor Czermak in the year 1863; but it was first successfully employed two years later by Dr. Burow, senior,[3] of Koenigsberg. In the year 1869 it was carried out, for the second time, by myself.[4] Since then eleven other cases have been placed on record, all of which are briefly detailed in Paul Bruns' work. The operation is recommended for the removal of laryngeal growths situated in the sub-glottic region, as well as for tumours in the upper part of the trachea, when, in such cases, laryngoscopic treatment cannot be carried out. Paul Bruns strongly recommends this operation for the extirpation of tumours originating from the free borders and the lower surface of the vocal cords or from below the glottis. If they are small and pedunculated, the crico-thyroid membrane alone, or the cricoid cartilage in addition, may be divided, but only if previous endo-laryngeal attempts at removal have been unsuccessful; if the growths are large, and attached by a broad base, laryngo-tracheotomy should be adopted, without any endo-laryngeal attempts, as by this operation alone a thorough cure can be expected.

[1] In this historical case, which occurred at the battle of Aboukir, half of the epiglottis was carried away by a musket-ball. Under Baron Larrey's treatment the patient recovered. Another similar case occurred in the same campaign, with an equally fortunate result. (Larrey: "Clinique chirurg." t. ii. p. 142; "Relation chirurg. de l'Armée d'Orient," p. 286, quoted by Ryland.)

[2] "Eröff. der oberst. Luftwege." Leipzig, 1864, p. 45.

[3] "Deutsche Klinik," vol. xvii. p. 165.

[4] Op. cit.: Case 81.

A few days before evulsion is attempted, an incision should be made as in ordinary (crico-thyroid) laryngotomy, but the crico-thyroid opening should be carefully dissected out, and all the membrane, muscle, and superficial parts removed, so that nothing is left but the two cartilages surrounding the opening; a canula should then be inserted. When all disposition to hæmorrhagic oozing has ceased, and all tenderness disappeared, the canula should be taken out, the chin thrown well back, so as to enlarge the crico-thyroid space as much as possible, and a careful examination made with one of Neudörfer's infra-glottic mirrors, to ascertain the exact origin of the growth. The mirror must then be laid aside, and the growth removed with short tube-forceps.

This operation can only be performed where the crico-thyroid membrane is of average size; if there is not room to effect removal, tracheotomy should be performed in the first instance instead of laryngotomy. The steps of the operation are almost the same as in (crico-thyroid) laryngotomy. When the patient has recovered from the tracheotomy, that is to say, a few days after the operation, the canula should be removed, and an attempt made to extirpate the growth. In carrying out the operation, the two sides of the windpipe require to be held back with retractors, in order that instruments may be conveniently passed into the larynx.

The patient should continue to wear the canula for a few months, or, at any rate, for a few weeks, in case eradication be incomplete, or recurrence take place.

## [MALIGNANT TUMOURS OF THE LARYNX.

**Under this head are included (1) Carcinomata, and (2) Sarcomata.]**

### CANCER OF THE LARYNX.

*Latin Eq.*—Carcinoma laryngis.
*French Eq.*—Cancer du larynx.
*German Eq.*—Krebs des Kehlkopfs.
*Italian Eq.*—Cancro della laringe.

DEFINITION.—*Primary cancer of the larynx, giving rise to hoarseness, dyspnœa, pain in the throat (darting to the*

*ears), sometimes to dysphagia, and ultimately causing death either by marasmus, or if tracheotomy has not been performed by apnœa.*

*Etiology.*—The cause of cancer of the larynx, as of malignant disease in general, has not yet been discovered. With respect to age, like the same disease in other parts, it is more frequent in advanced periods of life. The following table of 53 cases occurring in my practice illustrates this point. It will be seen that nearly the whole of the mortality (*i.e.* 83 per cent.) takes place between the ages of forty and seventy.

| | Cases. |
|---|---|
| From 10 to 20 years of age .. .. .. | 1 |
| ,, 20 to 30 ,, .. .. .. | 2 |
| ,, 30 to 40 ,, .. .. .. | 6 |
| ,, 40 to 50 ,, .. .. .. | 10 |
| ,, 50 to 60 ,, .. .. .. | 18 |
| ,, 60 to 70 ,, .. .. .. | 15 |
| ,, 70 to 80 ,, .. .. .. | 1 |

Ziemssen[1] publishes a table of 76 cases, collected from various authors, which gives very similar results, but includes 3 cases under nine years of age and 3 between the ages of ten and nineteen.

As regards sex, 42 of my cases were men and 11 women, whilst of Ziemssen's 76 collected cases 60 were males and 16 females. In 44 cases of laryngeal cancer observed by Fauvel,[2] the relative distribution with respect to age and sex is almost identical.

*Symptoms.*—The subjective symptoms of cancer of the larynx are not of a very distinctive character. Pain, dyspnœa, and dysphagia are generally present, but these symptoms vary according to the stage and exact site of the disease. My experience accords with Fauvel,[3] who states that at first the pain is confined to the larynx, and that not until ulceration has commenced does it radiate to the ears, orbit, and forehead. Pain is sometimes felt in the submaxillary and cervical glands, but this is comparatively rare.

Objectively, the groups of symptoms presented by laryngeal cancer are striking, and almost always sufficiently characteristic to enable the observer to arrive at a definite

[1] "Cyclopædia of Medicine," vol. vii. p. 891.
[2] "Traité pratique des Maladies du Larynx." Paris, 1876, p. 683. et seq.
[3] Ibid. p. 707.

opinion as soon as the disease has begun to develop organic changes. Hoarseness, sometimes due to implication of the recurrent nerve, is a very early symptom, and sometimes precedes all other symptoms by months or even years. The disturbance of phonation is of course progressive, but, as Dr. Fauvel has pointed out, the voice is seldom entirely lost, as it is in laryngeal phthisis, and by an effort the patient can generally succeed in producing a vocal sound. As soon as ulceration takes place there is fetor of the breath, and this is in itself a strong indication of the nature of the malady. As ulceration advances another symptom—hæmorrhage, which when serious is almost pathognomonic of cancer—may be met with. There may be copious bleeding from one or more small vessels being laid open, or the bloody discharge may only be sufficient to tinge the expectoration, which in almost all cases consists of ichorous muco-pus.

The external condition of the neck seldom affords any evidence as regards laryngeal cancer. Occasionally, however, at an advanced stage of the disease, the submaxillary glands are enlarged, and in some rare cases, owing to intra-laryngeal tumefaction, the alæ of the thyroid cartilage are pressed outwards, so that, as Isambert[1] has pointed out, the cartilage feels very much like a "crustacean carapace." More rarely still, the cancer eats through the integument.

As regards the general condition of the patient in laryngeal cancer, the essential cachexia does not present itself so uniformly as in malignant disease of other parts. This can readily be explained by the fact that the connection of the lymphatics with the glandular system is not nearly so free as in the pharynx and other parts (see page 209). Where, however, life is much prolonged, as in those cases in which swallowing is little interfered with, and tracheotomy has been performed at an early period, the characteristic cachexia is sometimes present. I only know of one instance in which cancer has developed secondarily in other parts of the body —the original disease having been in the larynx.

*The laryngoscopic appearances* vary according to the stage of the disease. At first the neoplasm appears as an undefined swelling, without any features which clearly indicate its nature. The site of the tumour is in most cases one of the ventricular bands (Fig. 61), but in some instances one of the vocal cords, the epiglottis, or the ary-epiglottic folds, have been the

[1] "Annales d. Malad. de l'Oreille et du Larynx." T. ii. p. 8.

first part to be attacked. Any part of the larynx may, however, suffer from the encroachment of the morbid growth, so

FIG. 61.—EPITHELIOMA OF THE LEFT VENTRICULAR BAND.

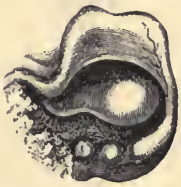

FIG. 62.—EPITHELIOMATOUS ULCERATION OF THE RIGHT ARY-EPIGLOTTIC FOLD AND THICKENING OF THE EPIGLOTTIS.

that after a time it becomes impossible to decide at what point it commenced (Fig. 62). Sometimes the growth covers the entire larynx, as in certain cases of diffuse epithelioma (Fig. 63).

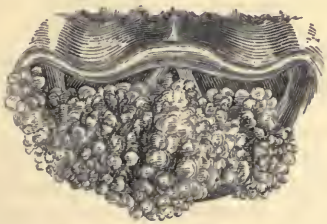

FIG. 63.—DIFFUSE EPITHELIOMA.

When the disease attacks the epiglottis it often causes so much general swelling, that the interior of the larynx cannot be seen; but occasionally it slowly eats away the cartilage

without causing any tumefaction. This is well shown in a case exhibited by me some years ago at the Pathological Society (Fig. 64).

FIG. 64.—EPITHELIOMA OF THE EPIGLOTTIS.

The following table shows the site of the disease in my 53 cases of primary laryngeal cancer, when the patients first presented themselves, or when the disease became manifest :—

| | Times. |
|---|---|
| The right ventricular band .. .. .. .. | 15 |
| The left ventricular band .. .. .. .. | 13 |
| The left vocal cord .. .. .. .. .. | 3 |
| The left vocal cord and sub-glottic region .. .. | 2 |
| The right vocal cord .. .. .. .. .. | 2 |
| The anterior commissure of the vocal cords .. .. | 2 |
| The epiglottis .. .. .. .. .. .. | 6 |
| The posterior surface of the cricoid cartilage .. | 1 |
| The whole of larynx .. .. .. .. .. | 9 |

It will be seen that in 56·7 per cent. of cases, one of the ventricular bands was the part first affected.

Both Fauvel[1] and Ziemssen[2] illustrate the question as to the site of cancer of the larynx by reference to their cases. Thus in 37 cases observed by the former physician, 26 occurred on the left side, and of these the ventricular band was first affected in 16. Ziemssen thinks that the vocal cords or the ventricles of Morgagni are the usual points from which the growth spreads upwards to the ventricular bands and ary epiglottic folds.

In the encephaloid variety of the disease the tumour appears in single nodules and ulcerates early. As soon as

[1] Op. cit. p. 693. [2] Op. cit. p. 891.

ulceration is established a process of sprouting commences, and as Fauvel has well pointed out, the vegetations issue *from the ulcerated surface*, and do not attack the surrounding mucous membrane, which remains more or less intact for some time, being but slowly eaten away by the gradual spreading of the primary ulcer. On the other hand, in epithelioma, as soon as an ulcer has formed, a series of vegetations spring up *about its margins*, and these new growths, by ulcerating in their turn, rapidly increase the original loss of substance. In scirrhus the disease in the earliest stage has much the appearance of a benign growth—a smooth papilloma or fibroma—but the surface of the growth and the neighbouring mucous membrane soon become inflamed, and in a short time distortion of some part of the larynx may be observed. From the foregoing remarks it will be understood that the laryngoscopic picture of a fully developed case of ordinary laryngeal cancer is that of a neoplasm, variable in size, single or multiple, whose surface is in a state of fungous ulceration, and frequently bathed in a purulent secretion or a sanguineous muco-pus.

In the only case of adenoid cancer that I have met with (Fig. 65), the disease commenced with ulceration of the epiglottis, and from this spot a nodulated growth about the size of a cherry developed.

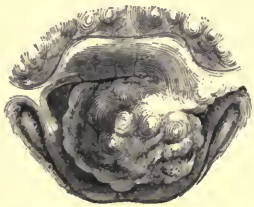

FIG. 65.—ADENOID CANCER.

*Pathology.*—Epithelioma is by far the most common form of cancer which affects the larynx. Out of my 53 cases,[1] 45

[1] In only 27 of the cases of epithelioma, and in only 3 of the cases of encephaloid disease, was the disease verified by post-mortem examinations. In both the cases of scirrhus the diagnosis was confirmed by microscopical examination. The paucity of autopsies is to be explained by the fact that we often lose sight of our cancerous patients as the fatal issue approaches. On this subject, Isambert (Op. cit. p. 3) judiciously remarks: "Hospital patients suffering from

were epitheliomatous (one of these adenoid), 2 scirrhous, and 6 encephaloid. In 68 cases collected by Ziemssen, 57 were examples of epithelioma, 9 encephaloid or scirrhous, and 2 villous. Fauvel,[1] however, in 39 cases met with different results, there having been 19 examples of encephaloid disease, 16 of epithelioma, and 2 doubtful cases. Schroetter[2] has reported 20 cases of cancer, 17 of which were examples of epithelioma, and 3 of encephaloid. In 10 out of 32 cases on which I made a post-mortem, the cartilages were necrosed; but I believe that these structures are affected in a much larger proportion of cases than these figures indicate. The condition of the cartilages cannot, however, be ascertained without destroying the specimen for museum-purposes, and this consideration has unfortunately prevented me from satisfactorily arriving at any conclusion on the subject. There was some œdema in every fatal case, as well as in 11 out of 21 cases seen only during life.

*Diagnosis.*—In the early stages of laryngeal cancer the diagnosis is often doubtful, but as soon as a tumour is formed, the experienced laryngologist can nearly always roughly determine its character. The appearance of a considerable but irregular and undefined swelling of a dirty grey or bright red colour on one of the ventricular bands, in a patient past the middle period of life, without any history of syphilis or previous severe chronic laryngitis, should raise grave suspicions of malignant disease. Similar conditions in other parts of the larynx will likewise call for close observation. As soon as the tumour ulcerates, the fungous character of the sore is usually very characteristic, but nevertheless in no case should the patient be condemned as suffering from cancer until all doubts have been cleared up by the trial of antisyphilitic treatment.

*Prognosis.*—As far as the present state of our knowledge extends, the only possible termination of any case of cancer is death, but at the same time the question must always arise as to how long life may last in any particular instance. The usual duration of epithelioma of the larynx appears to

cancer are not like the tuberculous; the former make no mistake as to their prospects, and disappear from our notice to die in their own homes." Thus it happens that we are so often deprived of the means of verifying our diagnosis.

[1] Op. cit. p. 689.

[2] "Laryngol. Mittheilungen." Wien, 1875, pp. 65 and 70.

be about eighteen months, and of encephaloid three years; in the cases which have been reported as lasting for ten or fifteen years[1], I cannot imagine that the disease was malignant from the commencement. On the other hand, patients often perish in a few months through some untoward event, such as acute œdema, perforation into the œsophagus, or lung complications.

*Treatment.*—Endolaryngeal treatment, thyrotomy, extirpation of the larynx, and tracheotomy are the various procedures which must be considered.

As regards *endolaryngeal treatment*, it need only be remarked that the radical removal of an ill-defined tumour cannot be efficiently accomplished by this method.

The results of *thyrotomy* have been shown by Dr. Paul Bruns[2] to be as follows:—

In 20 cases in which thyrotomy was performed for the removal of malignant growths (most of which were epitheliomata), death ensued after a few days in 2 cases. In the remaining 18[3] cases there was immediate recurrence in 4 cases, and recurrence a fortnight after the wound had healed in 4 cases; there was recurrence after from two to four months in 3 cases, after from five to six months in 2 cases, and within eighteen months in one case; the result was not reported in 3 cases. In the remaining single case no recurrence followed for a considerable time. It is true that death occurred twenty-two months after the operation from carcinoma of the left kidney and left suprarenal body, but there was no trace of recurrence in the larynx. The functional result was unfavourable in all these cases. It will thus be seen that the results of thyrotomy are extremely unsatisfactory. In some cases the operation was followed by immediate death, in others it could not be completed, and in the remaining cases, with two exceptions only, recurrence followed within a very short time. If the few statistics which have been collected are to be trusted, the average duration of life after the operation is only ten months. The mode of performing thyrotomy has already been explained (see page 325), but it may be remarked here that, in order to obtain any chance of success by this operation, every particle of the morbid

[1] See Ziemssen's table: Op. cit. p. 899.

[2] Op. cit.

[3] Paul Bruns, op. cit. (p. 73), says *seventeen* cases, but there actually appear to have been eighteen.

growth must be excised, and the resulting wound well cauterized with nitrate of silver, or even by the actual cautery.

According to Fauvel,[1] *tracheotomy* always adds several months and often even a year or two to the patient's existence. Thus in 7 cases of encephaloid left to their own course, the average duration of life was three years, whilst in 8 similar cases subjected to tracheotomy the mean of life was three years and nine months. Again, in 6 cases of epithelioma not tracheotomized, the average duration was one year and eleven months, whilst in 7 cases which were operated on the patients lived on an average four years.

In cases which seem suitable, recourse may be had to *extirpation of the larynx*, but this operation should only be undertaken at the immediate request of the patient after the subject has been fully explained to him in all its bearings.

The following description, for which I am mainly indebted to Dr. Foulis,[2] shows how extirpation should be effected:— A vertical incision should be made from the hyoid bone to the second ring of the trachea, and the front and sides of the larynx should be thoroughly freed and exposed by careful dissection, partly with the cutting blade of the scalpel, but as far as possible with its handle. Should there be any decided arterial hæmorrhage, the necessary ligatures must be applied. The trachea should be then drawn forward with a hook and cut across, care being taken to avoid penetrating the œsophagus; a syphon tube of vulcanite is then to be inserted into the windpipe. (In order that the syphon may fit accurately, it is well to have at hand several tubes of different sizes.) The upper and posterior attachments of the larynx should next be cut through, and in dissecting out the cricoid cartilage the risk of button-holing the gullet must be avoided by keeping the knife close to the cartilage. Sometimes the whole of the larynx must be taken away, but in Dr. Foulis' case he was able to spare the superior cornua of the thyroid cartilage and half the arytenoid cartilages. If there is much hæmorrhagic oozing from the raw surface it may be gently swabbed with a styptic solution; but local applications are, if possible, to be avoided, as they are apt to excite reflex irritation and cause retching. When the surfaces have healed and the gap in the throat has contracted to some extent, Gussenbauer's artificial vocal apparatus (*see* Tracheal Instruments) may be used.

[1] Op. cit. p. 716.
[2] "Lancet," October 13, 1877.

The operation, however, is not always of so simple a character as it has been described, for when the surgeon has made some incisions he may find that the disease is much more extensive than was previously supposed. Thus in one case Langenbeck was obliged to tie 40 arteries, to divide the lingual and hypoglossal nerves on both sides, and to cut away the two sub-maxillary glands and a large portion of the posterior half of the tongue. In a case of Billroth's, it was found necessary to remove the larynx, the three upper rings of trachea, the thyroid gland, the lower part of pharynx, and a large portion of the œsophagus. Extirpation of the larynx is in fact an operation in which, as Dr. Paul Koch[1] points out, "the skill of the surgeon is, in some cases, shown by the patient not dying under his knife."

The following analysis of the annexed tables shows the result of all the operations which have been performed up to the present time: Of nineteen cases operated on, one patient died six weeks after the operation from pericarditis, resulting from the passage into the mediastinum of a bougie, used for dilating the œsophagus, which had undergone cicatricial contraction as the result of the operation; eight patients died from collapse or pneumonia within a fortnight—in other words, directly after the operation, viz., 1 on the 2nd day, 1 on the 3rd day, and 1 on the 4th day; 2 on the 5th day, 1 within "a few days," 1 on the 11th day, and 1 within 14 days. In seven instances recurrence took place within a few months after the operation, viz., once in 3 months, once in 4 months, twice in 6 months, and once each in 7 months, 9 months, and 10 months respectively. Three cases were cured, one of which was an example of carcinoma and two of sarcoma; in one of the latter cases the patient died 18 months after the operation from pulmonary and tracheal phthisis. In these three cases the disease was absolutely confined to the larynx, whilst in many of the others the neighbouring tissues were also involved. It has already been shown that, owing to the arrangement of the lymphatic system in the larynx, disease of that part does not quickly infect the constitution. This fact favours the prospects of extirpation of the larynx, when the neoplasm is confined to its cavity. In any case, the rescue of three patients out of 19 (15·7 per cent.) from certain death must be regarded as one of the greatest triumphs of modern surgery.

[1] "Annales de l'Oreille," &c. March, 1879.

| No. | Name of Surgeon. | Date of Operation. | Patient's Age | Patient's Sex | Character and Situation of the Growth. | Part Removed. | Immediate Result. | Further Result and Remarks. | Described in |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Billroth (Vienna). | 1873, 31st Dec. | 36 | Male. | Carcinoma of the larynx. | Part of the two upper tracheal rings, cricoid, thyroid, both arytenoid cartilages, and lower third of the epiglottis. | Recovery. | Death from recurrence of the carcinoma, 7 months after operation. No P.M. | "Archiv für Klin. Chirurgie." Band xvii. Heft ii. p. 343. |
| 2 | Heine (Prag). | 1874, 28th Apr. | 50 | Male. | Carcinoma of the larynx. | Larynx in toto. | Recovery. | Death from recurrence of the disease 6 months later. | "Archiv für Klin Chirurgie." Band xix. p. 584. |
| 3 | M. Schmidt (Frankfurt). | 1874, 12th Aug. | 56 | Male. | Carcinoma of the larynx. | Cricoid, thyroid, and both arytenoid cartilages. | Death on the 5th day after operation from collapse. | | "Archiv für Klin. Chirurgie." Band xviii. Heft i. p. 189. |
| 4 | Maas (Freiburg). (At that time in Breslau). | 1874, 1st June. | 57 | Male. | Adeno-fibroma carcinomatosum. | Larynx in toto. | Death 2 weeks after operation from pneumonia. | | "Archiv für Klin. Chirurgie." Band xix. p. 507. |
| 5 | Schönborn (Königsberg) | 1875, 22nd Jan. | 72 | Male. | Carcinoma of the larynx. | Larynx in toto. | Death a few days after operation. | | "Berliner Klinische Wochenschrift." 1875, No. xxxviii. p. 525. |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 6 | Bottini (Turin). | 1875, 6th Feb. | 24 | Male. | Sarcoma of the larynx, partly round-celled, partly spindle-celled. | Larynx in toto. | Cure. This patient in May, 1878, was perfectly well, working in the fields, and acting as a postman between Miazzina and Trabaro. (Letter from Signor Domenico Barozzi, Sindaco of Miazzina.) | This is the most successful case on record, the patient having been able to undergo considerable bodily labour after the operation. | "Communicazione letta Innanzi, La R. Academia di Medicina di Torino" dal Prof. E. Bottini. Seduta del 30 Aprile, 1875. |
| 7 | v. Langenbeck (Berlin). | 1875, 21st July. | 57 | Male. | Carcinoma of the upper part of the larynx, the epiglottis, and the hyoid bone. | Larynx in toto, hyoid bone, part of the tongue, pharynx, and œsophagus. | Recovery. | Death 4 months after the operation from recurrence of the carcinoma in the lymphatic glands of the neck. | "Berliner Klinische Wochenschrift," 1875, Nro. 33, p. 453; and "Archiv für Klin. Chirurgie," vol. xxi. Supplementband, p. 136. |
| 8 | Billroth (Vienna). | 1875, 11th Nov. | 54 | Male. | Carcinoma of the larynx (diagnosed by Prof. Schroetter) affecting the organ generally. | Larynx in toto. | Death on the 2nd day after operation from croupous pneumonia. | | Information communicated by Dr. Mulhall, in reply to inquiries made in Vienna in March, 1878. |

| No. | Name of Surgeon. | Date of Operation. | Patient's Age | Patient's Sex | Character and Situation of the Growth. | Part Removed. | Immediate Result. | Further Result and Remarks. | Described in |
|---|---|---|---|---|---|---|---|---|---|
| 9 | Maas (Freiburg). | 1876, 5th Feb. | 50 | Male. | Epithelioma of the larynx. | Larynx in toto, with exception of the epiglottis and of a small piece of the cricoid cartilage. | Recovery. | About 3 months later, recurrence of the disease in the posterior part of the tongue. No operation allowed. Death 6 months after the first operation from hæmorrhage from the ulcerated carcinoma. | "Archiv für Klin. Chirurgie," Band xx. p. 535; and private communication by Prof. Maas. |
| 10 | Gerdes (Jever). | 1876, 30th Mar. | 76 | Male. | Carcinoma. | Larynx in toto. | Death on the 4th day from collapse. | | "Archiv für Klin. Chirurgie." Band xxi. Heft ii. p. 473. |
| 11 | Reyher (Dorpat). | 1876, May. | 60 | Male. | Carcinoma of the vocal cords. | Larynx in toto, with exception of the epiglottis. | Death on the 11th day after operation from hypostatic pneumonia. | | "St. Petersburger Medicinische Wochenschrift." 1877, Nro. 17 and 18. |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 12 | Kosinski (Warsaw). | 1877, 15th Mar. | 36 | Female. | Epithelioma of the larynx, with perforation of the skin. | Larynx in toto. | Recovery. | The patient died 9 months after the operation, recurrence of the disease having taken place | "Centralblatt für Chirurgie," Nro. xxvi. 1877, p. 401, and private communication by Dr. Kosinski. |
| 13 | Foulis (Glasgow). | 1877, 10th Sept. | 28 | Male. | Partly papilloma, partly spindle-celled sarcoma. | Larynx in toto, with exception of the superior cornua of the thyroid cartilage and half the arytænoid cartilages. | Cure. | Death from tracheal and pulmonary phthisis, March 1st, 1879. | "Lancet," Oct. 13, 1877, and March 29, 1879. |
| 14 | Wegner (Berlin). | 1877, 16th Sept. | 52 | Female. | Carcinoma of the larynx, originating from the right ventriculus Morgagni, size of walnut. | Larynx in toto, with epiglottis and upper half of the cricoid cartilage. | Cure. At the time of communication (7 months after operation) no recurrence. | Exhibited at the Congress of German Surgeons, Berlin, 1878, on the 12th of April. | Private communication by Dr. Wegner. |
| 15 | Bottini (Turin). | 1877, 29th Aug. | 48 | Male. | Epithelioma of the larynx. | Whole of larynx and portion of œsophagus. | Death on the 3rd day from double pneumonia. | Bloodless operation, having been entirely carried out with the galvano-cautery knife. | "Annales des Maladies de l'Oreille et du Larynx," July 1, 1878. |

## EXTIRPATION OF THE LARYNX—*Continued.*

| No. | Name of Surgeon. | Date of Operation. | Patient's Age | Patient's Sex | Character and Situation of the Growth. | Part Removed. | Immediate Result. | Further Result and Remarks. | Described in |
|---|---|---|---|---|---|---|---|---|---|
| 16 | v. Bruns, senior (Tübingen). | 1878, 29th Jan. | 54 | Male. | Epithelioma of the larynx. | Entire larynx. | Recovery. | Preliminary tracheotomy was not performed. Died Nov. 1st, 1878, from recurrence. | "Wiener Med. Presse," Nov. 17 1878. Further communication from Professor Paul Bruns. |
| 17 | Rubio (Madrid). | 1878, 11th May. | 41 | Male. | Necrosis of the cartilages of the larynx. | Entire larynx. | Death on the 5th day after the operation from marasmus. | | "Observacion Clinica," &c. Real Academia de Med. Madrid, 1878. |
| 18 | Billroth. | 1878, 7th July. | 50 Abt. | Male. | Epithelioma of larynx from left vocal cord to cricoid cartilage. | Left half of larynx. | Recovery. | Recurrence after six months. | Private communication by Professor Billroth. |
| 19 | Billroth. | 1879, 27th Feb. | 43 | Female. | Epithelial cancer of the pharynx, larynx, & thyroid gland. | Entire larynx, with part of pharynx and œsophagus. | Recovery. | Death from passage of bougie into mediastinum after 6 weeks. | Private communication by Professor Billroth. |

Reviewing the whole subject of treatment, our aim must be to prolong life when possible, and in every case to promote the euthanasia when the inevitable end draws near. From the foregoing remarks it will appear that the first indication can best be fulfilled by resorting to tracheotomy before the constitution has suffered from the impediment to free respiration. When deglutition is much interfered with, the patient must be fed by means of the œsophageal-tube, or by nutritive enemata. In order to relieve pain insufflation of morphia (gr. $\frac{1}{4}$ to $\frac{1}{2}$ mixed with powdered starch) may be employed once or twice daily with great advantage. By such topical applications alone it is often possible to keep the sufferer almost free from pain; whilst at the same time swallowing is rendered easy, and the appetite frequently improves. Whatever means we may adopt for the treatment of the local disease, it must not be forgotten to supplement them by general tonic and analeptic measures; and by well-considered dietetic and hygienic treatment an attempt should be made to preserve the integrity of the constitution as long as possible.

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## Secondary Cancer.

This affection scarcely deserves the name here used, my experience being similar to that of Dr. Fauvel, who remarks that he has never met with a case of secondary cancer of the larynx originating in infection.[1] It is very common, however, to find cancer involving simultaneously the posterior wall and sides of the œsophagus or lower portions of the pharynx, and at the same time the mucous membrane covering the posterior surface of the cricoid cartilage. Occasionally, also, cancer commencing in the sides of the pharynx or root of the tongue extends to the epiglottis or ary-epiglottic folds. These are, in fact, illustrations of the *contiguous* extension of the disease, and have been sufficiently considered under Cancer of the Pharynx (page 81, et seq.)

[1] Op. cit. p. 748.

## Sarcomata.

*Sarcomata* constitute a variety of growth, which is comparatively infrequent in the larynx, only five cases[1] having come under my notice. These growths may originate from any part of the mucous membrane of the larynx, and in one instance I met with a tumour of this kind (Fig. 66)

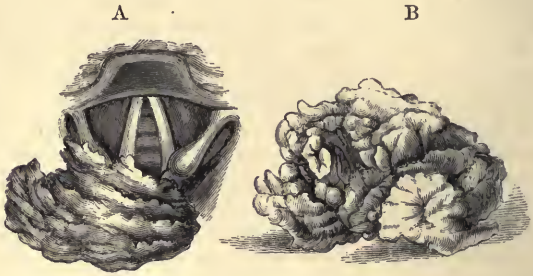


Fig. 66.—Sarcoma growing from the Posterior Surface of the Cricoid Cartilage.

A The growth *in situ*. B The growth after removal.

situated on the posterior surface of the cricoid cartilage. Two of my cases occurred in men aged respectively sixty-four and forty-two; the others in women, aged respectively fifty-three, forty-three, and thirty-seven. In one of these dysphonia had existed for twenty-three years. As a rule sarcomata rapidly attain a considerable size,[2] so much so, that in a relatively large proportion of the cases either thyrotomy or extirpation of the larynx has been found necessary. In one of my cases the surface of the growth was quite smooth, but in the others it was mammillated. The colour is generally red, but in one instance it was partly yellowish,[3] and in another case it was darker than that of the neighbouring mucous membrane. During life these tumours often cannot be distinguished by their appearance from papillomata, and even after death, if

[1] Op. cit.: Appendix A, Nos. 59, 49, and 95, and "Trans. Path. Soc." vol. xxi. The fifth case was that of a man, aged 64, whom I lately saw with Dr. Strong, of Croydon.

[2] Balassa: "Wien. Med. Wochenschrift," No. 92, 1868; also Ruppaner: "New York Med. Journ," March, 1870; and Schroetter: "Laryngol. Mittheil." Wien, 1875, p. 71.

[3] Laroyenne: "Gazette Hebdom." 1873, p. 780.

extensive ulceration has taken place, the naked-eye appearances cannot be relied on. The true character of the disease cannot in fact be determined with certainty except by the microscopical examination of a portion of the neoplasm.

These growths generally partake of the spindle-celled or fascicular character, but I recently met with an example of round-celled sarcoma, and the following is the microscopical report by Dr. Stephen Mackenzie:—"Sections show the whole of the tissues infiltrated with small round cells, completely filled by a nucleus, and with very scanty and delicate reticulum. The cells are most numerous in the sub-mucosa, where they pass in dense masses between the bundles of striated muscular fibres, and surround the blood-vessels and nerves. They do not much encroach on the mucosa. The epithelium covering the surface is in some places intact, but thickened; in other places it is irregular, as though eroded and undergoing proliferation. Nowhere are there epithelial protrusions into the mucosa. Some reticulated cartilage is cut across in the sections, and the cartilage cells have fallen out; the nuclei of the fibres are unusually distinct."

The prospects of the patient are much less satisfactory than in the case of benign growths, but more favourable than when cancer is present. In one case I succeeded in permanently removing the growth *per vias naturales*,[1] and Navratil,[2] Gottstein,[3] Türck,[4] and others have effected cures in this way. On the other hand, Balassa[5] attained success by thyrotomy, and Bottini[6] and Foulis[7] both restored their patients to health by extirpating the larynx.

If the growth cannot be entirely removed by intra-laryngeal treatment, either thyrotomy or extirpation of the larynx must be selected according to the site and extent of the growth.

[1] Mackenzie: Op. cit. Case 95.
[2] "Berlin. Klin. Wochenschrift," 1868, No. 49, p. 501.
[3] "Wiener Medizin. Wochenschrift," Dec. 30, 1868, No. 105.
[4] Op. cit. pp. 576, 577.
[5] Loc. cit.
[6] Loc. cit.
[7] Loc. cit.

## SYPHILIS OF THE LARYNX.

*Latin Eq.*—Syphilis laryngis.
*French Eq.*—Syphilis du larynx.
*German Eq.*—Syphilis des Kehlkopfs.
*Italian Eq.*—Sifilitide della laringe.

Definition.—*The local manifestations in the larynx of constitutional syphilis, constituting the so-called secondary, tertiary, or hereditary phenomena, and giving rise to dysphonia or aphonia and sometimes to dyspnœa.*

*Etiology.*—The precise causes which predispose the larynx to an attack of syphilis are not clear; but in many cases the disease is probably attracted to the part through local weakness, either hereditary or acquired. The season of the year has a marked influence in causing the outbreak to take place in the laryngeal mucous membrane in the early stages, and to a less extent later on. Thus out of 118 cases of secondary syphilis, of which I have notes, 79 commenced between September 1st and March 31st, and only 37 between April 1st and August 31st, whilst out of 110 cases of tertiary syphilis 66 commenced in the six winter months, and 44 in the summer months.

With respect to the frequency with which syphilis affects the larynx as compared with other parts, the statistics of Willigk [1] show that out of 218 cases of syphilis in the dead subject, in 15·1 per cent. there was disease of the larynx, in 10·1 per cent. the pharynx was affected, whilst the nose suffered in 2·8 per cent. Other observations give a somewhat different result. Out of 521 cases Engelsted [2] found the larynx affected only 25 times. In 1,000 syphilitic patients Lewin [3] diagnosed a laryngeal affection in 44. These figures are thus widely discrepant, and do not give any definite reply to the question at issue. In 10,000 consecutive cases of throat-disease examined at the Throat Hospital, I found 308 cases of laryngeal syphilis, as compared with 834 in which the pharynx was affected. (See Table A.)

[1] "Prager Vierteljahrschrift," xxiii. 2, p. 20, 1856.
[2] Virchow and Hirsch's "Jahresbericht," Bd. ii. 1868, p. 585.
[3] "Die Behandlung der Syphilis." Berlin, 1869.

With respect to age, most cases of laryngeal syphilis occur between twenty and forty, as will be seen on reference to Table B. Again, as regards the kind of syphilis most frequently met with in the larynx, Table A shows that tertiary phenomena are more common than secondary, being in the proportion of eighteen to eleven. From this it would appear that the larynx is most liable to be affected in patients in whom the constitutional malady has been of long standing. My colleague, Dr. Whistler,[1] has, however, had a different experience, for out of 170 cases of laryngeal syphilis, 88 corresponded to the secondary, and 82 to the tertiary stage.

TABLE A.

Showing number of cases of syphilis in 10,000 cases of throat-disease seen at the Hospital for Diseases of the Throat.[2]

| | | | | | |
|---|---|---|---|---|---|
| Pharynx | Primary— | Males | 0 | | |
| | | Females | 1 | | |
| | | | | 1 | |
| | Secondary— | Males | 348 | | |
| | | Females | 143 | | |
| | | | | 491 | |
| | Tertiary— | Males | 176 | | |
| | | Females | 163 | | |
| | | | | 339 | |
| | Hereditary— | Males | 2 | | |
| | | Females | 1 | | |
| | | | | 3 | |
| | | | | | 834 |
| Larynx | Secondary— | Males | 84 | | |
| | | Females | 34 | | |
| | | | | 118 | |
| | Tertiary— | Males | 120 | | |
| | | Females | 69 | | |
| | | | | 189 | |
| | Hereditary— | Males | 1 | | |
| | | Females | 0 | | |
| | | | | 1 | |
| | | | | | 308 |
| Trachea | Tertiary— | Males | 2 | | |
| | | Females | 1 | | |
| | | | | 3 | |
| | | | | | 3 |
| | | | | | 1145 |

[1] "Med. Times and Gazette." Sept. 28, 1878.

[2] Although I have altogether met with seven cases of primary syphilis of the pharynx, only one was seen among the 10,000 tabulated cases.

## TABLE B.

Showing AGES of patients affected with LARYNGEAL SYPHILIS.

### MALES.

| Secondary. | | Tertiary. |
|---|---|---|
| 0 | under 15 | 0 |
| 9 | 15 to 20 | 0 |
| 41 | 20 to 30 | 15 |
| 22 | 30 to 40 | 54 |
| 9 | 40 to 50 | 33 |
| 2 | 50 to 60 | 11 |
| 1 | 60 to 70 | 6 |
| 0 | 70 to 80 | 1 |
| 84 | | 120 |

### FEMALES.

| Secondary. | | Tertiary. |
|---|---|---|
| 2 | under 15 | 0 |
| 10 | 15 to 20 | 3 |
| 15 | 20 to 30 | 17 |
| 4 | 30 to 40 | 29 |
| 2 | 40 to 50 | 15 |
| 1 | 50 to 60 | 2 |
| 0 | 60 to 70 | 3 |
| 34 | | 69 |

## TABLE C.

Showing the particular conditions observed in syphilis of larynx.

### SECONDARY.

| | Congestion. | Condylomata. | Ulceration. | Totals. |
|---|---|---|---|---|
| Males | 35 | 33 | 16 | 84 |
| Females | 16 | 11 | 7 | 34 |
| | 51 [1] | 44 | 23 | 118 [2] |

### TERTIARY.

| | Superficial Ulceration with Laryngitis. | Deep and Extensive Ulceration. | Contraction. | Gummata. | Totals. |
|---|---|---|---|---|---|
| Males | 27 | 65 | 22 | 4 | 120 |
| Females | 21 | 42 | 5 | 1 | 69 |
| | 48 | 107 | 27 | 5 | 189 [3] |

[1] In 17 of these cases there was at the same time congestion of the trachea, and in 24 condylomata in the pharynx.

[2] In 81 of these cases there was at the same time secondary disease of the pharynx.

[3] Amongst these 189 cases, there were 7 of acute œdema, and 32 of chronic œdema.

*Symptoms.*—The phenomena of laryngeal syphilis vary, in different cases and in different stages, from the mildest to the most severe. Thus the patient may suffer merely from a slight inclination to clear the throat, or there may be extreme dyspnœa, advancing ultimately to such urgent suffocative attacks, as to require tracheotomy. Cough is occasionally present in the early manifestations, but rare in the later stages. The vocal function is generally impaired, and whilst at the commencement of the attack there is often only slight hoarseness, this may ultimately pass into complete aphonia. There may be no odynphagia at first, but at a later period swallowing, in some cases, becomes almost impossible. The absence of pain, when the patient is not swallowing, is very characteristic.

The pathological effects of syphilis in the larynx are extremely manifold, and comprise every kind of lesion that can be produced in the part, from a mere erythematous blush of the mucous membrane to great thickening, destructive ulceration, perichondritis, and necrosis of the laryngeal cartilages.

In *secondary syphilis*, condylomata are the most characteristic condition, but chronic hyperæmia (without mucous tubercles) and superficial ulcerations are often met with. As will be seen by reference to Table C, I met with 44 cases of condyloma among 118 patients suffering from the early symptoms of laryngeal syphilis; whilst among 88 patients in the same stage Dr. Whistler[1] saw 24 cases. On the other hand, Dr. Ferras[2] only found a single example in a hundred patients, Isambert[3] does not consider that there is such a phenomenon as laryngeal condyloma, and both Waldenburg[4] and Lewin[5] hesitate as to whether the characteristic mucous tubercles of syphilis are ever found in the larynx, being inclined to relegate the neoplasms usually described as such to the class of gummata. Again, whilst Gerhardt and Roth[6] found condylomata in 18 instances out of 56 patients suffering from constitutional syphilis, in a series of examinations at the Lock Hospital, I observed condylomata only twice among 52 patients. These wide discrepancies may perhaps be accounted for in a measure

[1] Ibid.
[2] "Thèse de Paris," 1872.
[3] "Annales des Maladies de l'oreille," &c. T. ii. p. 239.
[4] "Respiratorische Therapie," II. Aufl. 1872, p. 366.
[5] Loc. cit. p. 113.
[6] Virchow's "Archiv." Bd. xxxi. 1861, Hft. 1, § 7.

by the different periods of the year at which the observations were undertaken, some having been made in the summer and some in the winter, but they are in part to be explained by the fleeting character of laryngeal condylomata, and by the different appearance which condylomata present in the larynx as compared with the pharynx—a difference which renders them likely to be overlooked. In the larynx they generally appear as smooth yellow projections, sometimes round, but more often oval, varying in diameter from three to seven millimetres, but in rare cases attaining a breadth of a centimetre. They are seldom so white as in the pharynx, and the surrounding mucous membrane is not generally so congested. Moreover, they are less disposed to superficial ulceration, and they generally disappear quickly—even without treatment. The epiglottis and the inter-arytenoid commissure are the parts which I have most frequently

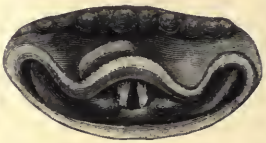

FIG. 67.—CONDYLOMA ON THE UPPER SURFACE OF THE EPIGLOTTIS.

found affected, but I have occasionally seen condylomata on the vocal cords.

Superficial ulcerations of limited extent are, as already remarked, occasionally met with. They generally occur from six to twelve months after the primary infection, and heal after a few weeks' treatment.

In secondary syphilis, we also sometimes meet with very obstinate congestion of the laryngeal mucous membrane, but it is often impossible to tell whether this condition is really due to the syphilitic dyscrasia. I found marked congestion in 51 out of 118 cases of secondary syphilis. In every one of these 51 cases there were at the same time other well-marked symptoms of constitutional syphilis—in 24 condylomata in the pharynx. As I pointed out long ago[1] there is nothing characteristic about the congestion of syphilis, and I never consider a congestion syphilitic unless there are other well-marked evidences of the disease. Even then the laryngeal hyperæmia is often the result of accidental catarrh, and in no

[1] Russell Reynolds' "System of Medicine," vol. iii. p. 465.

sense due to the syphilis. On the other hand, M. Dance[1] has gone so far as to describe roseolar, papular, and tubercular eruptions of the laryngeal mucous membrane, corresponding to similar manifestations on the skin. I have never been able to verify these observations, nor have they been confirmed by other physicians.

In *tertiary syphilis* the phenomena met with are ulceration, gummata, and cicatricial stenosis. The earliest, but not most frequent, symptom is obstinate *superficial* ulceration, accompanied by considerable hyperæmia of the mucous membrane. Dr. Whistler[2] has well described this condition, under the name of "relapsing ulcerative laryngitis." When these superficial ulcers occur within a year of the primary affection, I have been in the habit of classifying them under the head

FIG. 68.—THICKENING AND ULCERATION OF THE EPIGLOTTIS.

of secondary syphilis, though this is a mere arbitrary distinction. But when they appear three or four years after inoculation, they may fairly be regarded as tertiary. I have met with one instance of this affection in a patient who had been successfully treated fifteen years previously at Aix-la-Chapelle. The ulceration generally attacks the vocal cords, but I have frequently seen the inter-arytenoid fold, and occasionally the ventricular bands affected.

*Deep* and destructive ulceration is, however, the characteristic morbid condition of the later stages of laryngeal syphilis. The ulcers may form three or four years after inoculation, but they sometimes occur twenty, thirty, forty, and even fifty years after the date of infection without the occurrence of intermediate symptoms, and when, indeed, the primary cause may have even been altogether forgotten. Their effect is to produce great loss of substance, and the con-

[1] "Thèse de Paris," 1868.
[2] "Med. Times and Gazette," 1878. Nos. 1480, 1484.

sequent changes in the form of the epiglottis and other parts of the larynx are very remarkable. The ulcers may form in any region of the larynx, but the epiglottis is the part most frequently affected—one of the most common conditions consisting of general thickening of the valve, with ulceration of the central portion or lateral free edge (Fig. 68.) The upper surface is more often attacked than the under surface. Under these circumstances great dysphagia is usually experienced, but when the ulcers are healed, swallowing can

FIG. 69.—DESTRUCTIVE ULCERATION OF THE EPIGLOTTIS: IRREGULAR HYPERTROPHY OF THE LEFT VENTRICULAR BAND AND ARY-EPIGLOTTIC FOLD.

generally be effected without trouble, even though nearly the whole of the valve is destroyed. When the walls of the pharynx are also ulcerated, there is danger of the edges of the epiglottis uniting with them. This condition gives rise to one of the most dangerous forms of dysphagia, as well as to serious dyspnœa. The ulcerative process frequently

FIG. 70.—THICKENING AND DESTRUCTIVE ULCERATION OF EPIGLOTTIS.

destroys the mucous and sub-mucous tissues to a very considerable extent, and sometimes attacks the muscles, perichondrium, and cartilage. It is often associated with œdema, and is also not unfrequently followed by the formation of false excrescences, which are most apt to occur on the interarytenoid fold and the anterior surface of the posterior wall of the larynx, but are occasionally seen on the vocal cords.

In these advanced stages syphilitic gummata are occasionally, though very rarely, formed in the sub-mucous tissue and muscles of the larynx. They usually appear as round, smooth elevations (Fig. 71), generally of the same colour as the rest

FIG. 71.—GUMMA.

of the mucous membrane, but sometimes of a yellow tint. They are most frequently found on the anterior surface of the posterior wall of the larynx, and generally in groups (Fig. 72). Mandl[1] mentions the case of a negro suffering

FIG. 72.—GUMMATA.

from severe pharyngeal syphilis, in whom numerous gummata, of a greyish-yellow colour, could be seen on the epiglottis and ventricular bands; and Norton[2] has described and figured a remarkable case, in which suffocation resulted from a gumma, the size of a pigeon's egg, in the right ary-epiglottic fold. The ulceration which results from gummata is of the deepest and most destructive kind, and often penetrates to the perichondrium.

Even when the ulcerative process is arrested, however, the danger does not cease, for the cicatrices often undergo such a degree of contraction as to greatly lessen the calibre of the larynx. Indeed, the stenosis which so often results from tertiary ulceration is one of the greatest dangers of the

[1] "Maladies du Larynx." Paris, 1872, p. 700.
[2] "Affections of the Larynx." London, 1875, p. 86.

disease. Sometimes the narrowing of the passage is caused by a web between the vocal cords (Fig. 73), and no less than six cases of this sequel of laryngeal syphilis have been reported by Dr. Elsberg,[1] of New York. In these cases there is generally complete aphonia. Sometimes the crico-

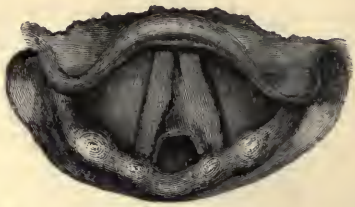

FIG. 73.—WEB BETWEEN VOCAL CORDS FOLLOWING SYPHILITIC ULCERATION.

arytenoid articulation is enlarged and the joint stiff, and thus the vocal cord may be permanently fixed in the median line, at the side of the larynx, or at some intermediate position. Sometimes the cicatricial process produces the most curious and irregular distortions and outgrowths; indeed, so much is this the case, that it is occasionally almost impossible to identify the various parts (Fig. 74).

FIG. 74.—OLD CICATRICES ON THE EPIGLOTTIS: CONTRACTION OF THE WALLS OF THE PHARYNX AND HORN-SHAPED OUTGROWTH ON LEFT SIDE.

*Hereditary syphilis* is occasionally met with in children, though I have never seen a case in a child younger than seven years. In each of the five examples I have met with there was ulceration of the edge of the epiglottis, with

[1] "Syphilitic Membranoid Occlusion of the Rima Glottidis." New York, 1874.

exposure of the cartilage. The only instance of the disease occurring in an *infant* that I am acquainted with is that observed by Isidor Frankl.[1] The subject was an infant, who was attacked with coryza two months after birth, and died from acute stenosis of the larynx in about three weeks. On post-mortem examination necrosis of the cricoid and left arytenoid cartilage was found and syphilitic disease of the liver.[2] Rauchfuss[3] mentions that, in the "Post-Mortem Records of the St. Petersburg and Moscow Foundling Hospitals," there are a few cases of deep ulceration and perichondritis in infants of from two to three months old.

*Pathology.*—The anatomical changes which the laryngeal structures undergo in syphilis have been investigated by Virchow,[4] who describes the phenomena with considerable detail. The general pathological features, however, have been so much touched upon in dealing with the laryngoscopic appearances that it is only necessary to make a few remarks in this place. Condylomata are the result of a hyperplasia of the epithelium of the mucous membrane, generally attended with copious cell proliferation. They show little disposition to ulceration, except of the most superficial character, and generally disappear by a process of molecular absorption. The ulcers which form so quickly in tertiary syphilis, result from a low form of inflammation which rapidly leads to liquefaction of tissue. Gummata are developed in the same way as in other organs, but they are very rare.

*Diagnosis.*—Syphilitic diseases of the larynx can generally be recognized without difficulty, either by the general features of the case or by the laryngoscopic appearances. A few cases may be doubtful at first, but simple hyperæmia is almost the only condition in which the judgment need remain long suspended. In the absence of other symptoms, it is impossible to tell whether a congestion is a simple catarrhal phenomenon, the outcome of syphilis, or the precursor of phthisis. In the early superficial ulcerations, the practitioner may likewise hesitate for a time between catarrh

[1] "Wiener Mediz. Wochenschrift." Nos. 69 and 70, 1868.

[2] A somewhat similar case is mentioned by Rollet, "Dict. des Sc. Med." art. "Larynx," p. 693.

[3] "Die krankheiten des Kehlkopfes und der Luftröhre im Kindesalter." Tübingen, 1879, p. 210.

[4] "Die krankhaften Geschwülste," Bd. ii. Part 2, p. 413.

and syphilis, but the progress of the case soon demonstrates its nature.

The ulcers of tertiary syphilis may generally be easily distinguished from cancer and phthisis—the only affections in which error may occur through want of care.

In *syphilis* the development of the ulcer is acute, often occupying a few days only. There is generally considerable irregular swelling of a decidedly inflammatory—often œdematous—character. When the epiglottis is attacked, the upper surface is the most frequent site of the disease. Above all it should be observed that the ulcer is most frequently solitary, and hence (except in the case of the epiglottis, where it is often central) generally unilateral, and that there are scarcely ever more than two separate ulcers. These ulcers are rather deep, irregularly round or oval in shape, and commonly have a diameter of a centimetre to a centimetre and a half.

In *phthisis* the development of the ulcers is slow, generally only occurring after the throat symptoms have existed for several months. They are nearly always preceded by swelling of the mucous membrane, which is of a somewhat uniform character, partaking of the appearance of an infiltration, and extremely pale. The pallor of the mucous membrane is, indeed, a very characteristic condition. When the epiglottis is attacked it is the under surface which usually suffers; the ulcers are almost always numerous and bilateral; they are generally round and seldom more than two or three millimetres in diameter, except where the coalescence of several ulcers has produced a large breach, in which case they may attain the diameter of half a centimetre or more. In cases in which syphilis attacks phthisical patients the local symptoms are sometimes very obscure, and the diagnosis may be very difficult.

In *cancer*, the development of the ulcer is intermediate, as regards time, between syphilis and phthisis, generally occupying a few weeks. As a rule the ulcer is preceded by the development of a growth, and there are nearly always nodular excrescences upon or around the ulcer. The neighbouring mucous membrane is generally acutely inflamed. The ulcers are solitary, of irregular shape, and often attain a diameter of two or three centimetres.

For further points of differential diagnosis the reader is referred to the articles on "Laryngeal Phthisis" and "Malignant Tumours of the Larynx." Lupus, lepra, and glanders all give

rise to ulcerations and thickening of the laryngeal structures; but they never occur until other general symptoms have made the nature of the disease only too manifest.

Although the experienced laryngologist can at once feel sure that certain ulcers are syphilitic, yet cases occasionally occur in which it is impossible to arrive at a decision with the laryngeal mirror alone. The diagnosis, under such circumstances, must be arrived at by attention to the history of the case, and by a consideration of the concomitant phenomena, such as the state of the pharynx, the skin, the lungs, and the general appearance of the patient. Should any doubt remain, it must soon be cleared up by watching the effects of treatment, syphilitic affections rapidly yielding, if only for a time, to appropriate treatment. As Krishaber[1] has pointed out, false excrescences resulting from syphilitic ulceration can generally be distinguished from true growths by the surrounding hyperæmia, which as a rule is altogether absent in the case of simple neoplasms.

*Prognosis.*—There are few cases of syphilis in which the prognosis, at least as regards life, can be said to be absolutely unfavourable. Under appropriate treatment the most destructive ulceration can generally be arrested, although frequently at the expense of a considerable loss of substance and great local deformity. Though stenosis may occur, in no class of cases are the immediate effects of tracheotomy so successful. It must be remembered, however, that where much ulceration of the vocal cords or necrosis of the cartilages has taken place, the voice must generally be looked upon as irrecoverably lost, whilst, if tracheotomy is called for, the patient will probably have to continue to wear the canula for life. The prognosis, as Krishaber[2] has pointed out, is unfavourable in proportion as the disease approaches the windpipe, and the most dangerous cases, as has been shown by Dittrich,[3] Porter,[4] and others, are those in which there is perichondritis of the cricoid and thyroid cartilages. Under these circumstances a fatal issue may ensue from acute œdema or from extensive suppuration of the surrounding soft parts. A rare instance is mentioned by Türck,[5] in which fatal

[1] "Annales des Maladies de l'Oreille," &c. September, 1878.
[2] "Gaz. hebdom.," Nos. 45, 46, and 47. 1878.
[3] "Prager Vierteljahrschrift," Bd. xxvii. 1850.
[4] "Observations on the Surgical Pathology of the Larynx and Trachea." Cases 28 and 29. Dublin.
[5] Loc. cit. p. 413.

hæmorrhage took place from a large and deep ulcer of the left vocal cord.

*Treatment.*—The mode of treatment recommended under "Syphilis of the Pharynx" (pp. 93 and 94) should be pursued when the larynx is affected. But here it may be remarked that the inhalation of an atomised solution of bichloride of mercury (1 in 1,000 or 500), first recommended by Demarquay and Schnitzler, has received such strong testimony from Waldenburg[1] and Massei[2] that there can be no doubt of its remarkable efficacy in obstinate syphilitic affections of the larynx. Severe cases of œdema generally yield to the free exhibition of iodide of potassium, but if there is much dyspnœa, scarification may be required, and if, in spite of this treatment, suffocation threatens, recourse must be had to tracheotomy. When a web forms in the larynx it can sometimes be taken away with cutting-forceps, but Dr. Whistler's "cutting-dilator" (p. 264) has proved more serviceable to me in these cases. Electric cautery has been most successfully employed by Dr. Elsberg.[3] The success of any treatment, however, depends mainly on the density of the web; if it is thin no trouble is experienced, but when the membranous formation is tough and thick, the curative treatment is seldom of any avail, and I have not found thyrotomy succeed where endo-laryngeal methods have failed. In cases of stenosis from cicatricial contraction or disease of the cartilages, the process of dilatation described under Perichondritis should be pursued.

[1] "Die locale Behandlung der Krankheiten der Athmungsorgane." Berlin, 1872, pp. 244 and 371.

[2] "Patologia e Terapia della Laringe." Milano, 1877.

[3] Op. cit.

## LARYNGEAL PHTHISIS.

*Latin Eq.*—Phthisis laryngea.
*French Eq.*—Phthisie laryngée.
*German Eq.*—Kehlkopfschwindsucht.
*Italian Eq.*—Laringitide tuberculosa.

DEFINITION.—*A chronic affection of the larynx attended by tumefaction and ulceration of the softer structures, and frequently by perichondritis and caries of the cartilages, arising from the local deposit of tubercle, which, as far as experience goes, is invariably preceded by a similar disease of the lungs.*

*History.*—Petit[1] was the first physician to call attention to this disease, and his treatise, which appeared in 1790, was followed two years later by a more important work by Portal.[2] In 1802 Sauvée[3] collected these writings in a monograph which fully established the main features of the malady, but it was not till 1819 that Laennec[4] insisted on the tubercular nature of the disease. This view was disputed a few years later by Louis,[5] who, as is well known, attributed the ulceration to the corroding effect of the sputa in pulmonary phthisis. The disease was subsequently investigated by Trousseau,[6] Andral,[7] and Albers,[8] with considerable minuteness, but Hasse[9] first described the deposit of tubercles in the mucous membrane of the larynx with anything like detail. Rheiner,[10] Rokitansky,[11] and Virchow,[12] subsequently insisted on the presence of tubercles in this part, and other observers have testified to their frequent deposit, but it remained for Heinze,[13] in his recent exhaustive monograph, to place the pathology on a thoroughly scientific basis. This elaborate work cannot be said to have been shaken by Beverley Robinson,[14] who (apparently unaware of Heinze's labours) remarks that "the elevations which have been described in the larynx under the name of miliary tubercle are none other, as a rule, than small spherical swellings, which are occasioned by the filling up with transparent fluid of the closed follicles of the sub-

[1] "De phthisi laryngea Dissertatio," Montpellier, 1790. We have not included a case of ulceration of the larynx described by Morgagni ("De Sedibus," vol. 1, p. 10), as the lungs were not affected in this instance.
[2] "Traité de la Phthisie Pulmonaire." 1792, p. 819.
[3] "Recherches sur la Phthisie Laryngée." Paris, 1802.
[4] "Traité de l'Auscultation," etc. Paris, 1819.
[5] "Recherches sur la Phthisie." Paris, 1825.
[6] Trousseau et Belloc: "Traité de la Phthisie Laryngée." Paris, 1827.
[7] "Clinique Médicale," t. ii. Paris, 1829.
[8] "Pathologie und Therapie der Kehlkopfskrankheiten." Leipzig, 1829.
[9] "Spec. Pathol. Anatomie." Leipzig, 1841.
[10] Virchow's "Archiv." Bd. v. p. 219.
[11] "Lehrbuch d. pathol. Anatomie," iii. Wien, 1861.
[12] "Geschwülste," ii. Berlin, 1864-65.
[13] "Die Kehlkopfschwindsucht." Leipzig, 1879.
[14] "Ulcerative Phthisical Laryngitis." "American Journ. Med. Sciences," April, 1879.

mucous reticulum, which have been described by Heitler (Stricker's 'Med. Jahrbücher,' vol. iii. and iv. 1874) and Coyne ('Recherches sur l'Anatomie Normale de la Muqueuse du Larynx.'" Paris, 1874.)

*Etiology.*—The *exciting* cause is almost invariably to be found in the previous existence of pulmonary phthisis. Common experience shows that in the case of adults, at least, tubercle is rarely, if ever, found in any organ or tissue of the body, unless it has been previously deposited in the lungs, and the larynx proves no exception to this rule. It is true that it cannot be disproved that the deposit of tubercle in the laryngeal mucous membrane may not precede that in the lungs; and it is *possible* that the larynx may be the seat of the disease without the lungs ever becoming affected. All observation, however, points in the opposite direction, for in nearly every case of laryngeal phthisis, disease of the lungs can be detected with the stethoscope. Dr. Heinze remarks that during life it is difficult to determine the existence of primary tuberculosis of the larynx, because on the one hand the most careful physical examination may fail to detect small cheesy deposits or indurated spots in the lungs, especially when they are of long standing and deeply situated, and because on the other hand it is impossible by means of the laryngoscope to be absolutely sure that any deposit in the larynx is actually tubercular. Even when the tubercular diathesis is strongly marked, however, and when other organs are affected with tubercle, deposit is not found in the larynx unless the lungs are at the same time the seat of this disease. In 100 cases of pulmonary phthisis which I examined at the London Hospital in the second and third stages, I found laryngeal phthisis in 33 [1] cases. In 1,226 cases of pulmonary phthisis occurring at the Pathological Institute of Leipzig between the years 1867 and 1876, there was, according to Heinze, laryngeal ulceration in 376 cases, or 30·6 per cent.

The *predisposing* circumstances are sex and age, men being much more frequently affected than women, and the vigorous period of adolescence—twenty to forty—being the time of life at which the disease is most common, the greatest number of cases, however, occurring between twenty and

[1] In these 100 cases of pulmonary phthisis the laryngeal mucous membrane was normal twenty-nine times, anæmic five times, congested twenty-seven times, superficially ulcerated five times, aphthous once, infiltrated twenty times, infiltrated and ulcerated thirteen times.

thirty. In 500 cases of marked laryngeal phthisis which I examined during life there were 365 males and 135 females, or 2·70 males to 1 female, and in 100 autopsies I found the same ratio, the proportion being 73 males to 27 females. From an analysis of 70 cases, Dr. Marcet[1] states that twice as many men as women are affected. Dr. Heinze gives the proportion of males to females as 33·6 to 21·6. The following tables illustrate some of the points referred to.

TABLE A.

*Sex and age in 500 cases of laryngeal phthisis examined during life by the author.*

| MALES. Ages. | | FEMALES. Ages. | |
|---|---|---|---|
| 15 to 20 | 13 | Under 15 | 1 |
| 20 to 30 | 149 | 15 to 20 | 21 |
| 30 to 40 | 115 | 20 to 30 | 45 |
| 40 to 50 | 61 | 30 to 40 | 47 |
| 50 to 60 | 27 | 40 to 50 | 21 |
| | | 50 to 60 | 0 |

TABLE B.[2]

*One hundred autopsies in cases of Laryngeal Phthisis by the author.*

| MALES. Ages. | | FEMALES. Ages. | |
|---|---|---|---|
| 5 to 10 | 1 | 5 to 10 | 0 |
| 10 to 15 | 3 | 10 to 15 | 1 |
| 15 to 20 | 11 | 15 to 20 | 5 |
| 20 to 30 | 31 | 20 to 30 | 11 |
| 30 to 40 | 23 | 30 to 40 | 8 |
| 40 to 50 | 3 | 40 to 50 | 2 |
| 50 to 60 | 1 | 50 to 60 | 0 |

TABLE C.

*Cases occurring in the Pathological Institute of Leipzig, from* 1867 *to* 1876.

| | Pulmonary Phthisis. | Laryngeal Ulceration. |
|---|---|---|
| Under 1 year. | 13 | 1 |
| 1 to 10 | 39 | 4 |
| 11 to 20 | 92 | 23 |
| 21 to 30 | 406 | 130 |
| 31 to 40 | 303 | 112 |
| 41 to 50 | 179 | 67 |
| 51 to 60 | 104 | 27 |
| 61 to 70 | 53 | 9 |
| — to 70 | 25 | 3 |
| Of unknown age | 12 | |

[1] "Lancet," February 27, 1875.

[2] None of the cases contained in Table A are included in Table B.

Although my statistics only include one case of laryngeal phthisis under ten years of age, and Heinze's only four, I have met, in addition to these, with three cases of children between five and ten years of age, and four between ten and fifteen, and Rheiner [1] has reported a case at four years.

Pursuing the etiology somewhat further, the subject is beset with great difficulties, and it has not yet been determined what is the cause of the secondary deposits in the larynx. Louis,[2] whilst maintaining that ulceration, when present, was caused by the destructive action of the pulmonary sputa, nevertheless admitted that the ulceration bore no relation to the irritating quality of the expectoration, and that there were many cases of extensive destruction of the lungs, and old tubercular cavities without any laryngeal ulceration. It has been pointed out by other physicians that the laryngeal ulceration occurs in some cases before any cavities are formed, and also in some cases in which there is scarcely any expectoration. It has been urged that ulceration of the larynx is not generally present in cases of gangrene of the lung, where the pus is probably of a more irritating nature, but it must not be forgotten that gangrene is more likely to occur in the non-scrofulous than otherwise, and, hence, this argument falls to the ground. Further, the fact that the ulcerations in the larynx are scattered is opposed to the theory that the disease could be caused by the expectorated mucus which comes in contact with all parts of the larynx. That the disease originates from the corrosive action of the sputa is, moreover, rendered improbable by the pathological investigations of Heinze, who shows (see Pathology) that the destructive process commences from within, not from without. Rheiner's [3] theory that the ulceration is caused by friction has also been disposed of by Heinze, who has pointed out that the catarrhal inflammation, which almost invariably precedes ulceration, prevents the vocal cords coming together, and that the vocal processes which are stated by Rheiner to be a frequent site of the disease do not actually come in contact with one another. It may be added that the under-surface and base of the epiglottis, which are comparatively free from attrition, are more frequently attacked by tubercular ulceration than the edges which are much exposed to friction. Some physicians suppose that the constant hacking cough, which is a characteristic symptom of

[1] Loc. cit. [2] Op. cit. [3] Loc. cit.

tubercular disease of the lungs, causes the morbid process to be developed in the larynx.[1] It is only, however, from a theoretical standpoint that this cause can be upheld as being concerned in the production of laryngeal phthisis.

In some cases, secondary tubercle is developed in the intestines, in others in the larynx; sometimes the kidneys, sometimes the spleen are the parts secondarily implicated; but the reason why tubercle in any given case shows a greater preference for one organ than for another is probably due to weakness on the part of the organ attacked. The weakness of the larynx may either be congenital, or it may be acquired, owing to that organ having been frequently attacked by inflammatory affections of a more or less pronounced character. Thus, a great many patients suffering from laryngeal phthisis date the commencement of their illness from a severe catarrh. A chronic weakness of the vocal organ may also be developed by persistent over-exertion of the voice, as in the case of public speakers, singers, auctioneers, military and naval officers, &c. Under these circumstances some special laryngeal affection is ultimately induced, which, if tuberculosis be present in the system, is very likely to culminate in the local phenomena of laryngeal phthisis. Dr. Marcet[2] did not, however, find the excessive use of the voice a frequent cause of the disease in his seventy cases, but attributed its occurrence rather to sedentary in-door occupations, which I have shown (see Catarrhal Laryngitis) to be a frequent predisposing cause of sub-acute inflammation of the larynx.

In returning to the subject of the possible primary deposit of tubercle in the laryngeal mucous membrane, I must again refer to Dr. Heinze's valuable labours. In addition to collecting and analyzing the records of the Leipzig Pathological Institute for many years, this pathologist during the year 1876 made most minute pathological investigations upon 50 bodies of persons who had died of pulmonary phthisis. In 47 of these there was tubercular ulceration of the larynx or trachea, and in no instance did it appear that the deposit in the larynx or trachea had preceded the pulmonary deposit. "No case of primary laryngeal phthisis," he observes, "has ever been

[1] "Dict. des Sc. Méd." Paris, 1868. Article "Larynx," by Krishaber and Peter, p. 666.

[2] Loc. cit.

published in which post-mortem examination has shown that there was true tubercular ulceration of the larynx as a primary affection whilst the lungs were intact." He further remarks, "that it is *possible* that tubercle may first be deposited in the larynx, and afterwards in the lungs, but this is difficult to establish, as cases of simple laryngeal phthisis would only come under observation through some intercurrent acute affection of some other organ than the lungs, or from some fatal accident. As a rule, on post-mortem examination, the lung affection is much more advanced and of much older date than the laryngeal disease." I formerly published some fatal cases which I believed were examples of laryngeal phthisis, in which the lungs were healthy, but I must freely admit that I formed my opinion from naked-eye appearances, not from histological examination.

*Symptoms.*—At the commencement there is nothing characteristic about the symptoms of this malady. The usual phenomena of chronic laryngitis are present, but the laryngeal symptoms are to some extent masked by those dependent on the pulmonary condition. The following table shows the proportionate frequency of some of the symptoms :—

TABLE D.

*Symptoms in 500 cases of Laryngeal Phthisis examined during life.*[1]

| | |
|---|---|
| Aphonia .. .. .. .. | 123 |
| Dysphonia .. .. .. .. | 337 |
| Dysphagia .. .. .. .. | 151 |
| Sore throat .. .. .. .. | 62 |
| Stridulous breathing .. .. | 8 |
| Great dyspnœa requiring tracheotomy .. | 3 |
| Cough .. .. .. .. | 427 |
| Shortness of breath on slight exertion .. .. | 415 |

*Hoarseness* is generally present in the early stages, aphonia when the disease is advanced, but sometimes there is functional aphonia from the very first.[2] It will be seen from the

[1] The notes of nearly 200 of these cases were taken for me in 1873 and 1874 by Dr. Porter, of St. Louis, at that time acting as one of my clinical assistants. This physician has since written some excellent practical directions (hereinafter referred to) as regards the treatment of laryngeal phthisis.

[2] In the year 1865 I examined a number of cases of pulmonary phthisis in which the voice was affected at the Brompton Hospital, and found the impairment of function to be neurotic (due to loss of power of the adductors or tensors) in nearly one-third. "Hoarseness and Loss of Voice in Relation to Nervo-muscular Affections of the Larynx." 2nd edition, 1878, page 3.

printed table above that the vocal function was more or less impaired in 460 out of 500 cases, *i.e.*, in 92 per cent. In 100 cases of pulmonary phthisis examined at the London Hospital, in which there was no laryngeal phthisis, there was hoarseness, either constant or occasional, in 37 cases. In 1 of these there was paralysis of the right recurrent nerve, in 4 the aphonia was due to imperfect tension, or insufficient adduction of the vocal cords, whilst in the remainder the cause of the impaired function was slight congestion of the vocal cords.

*Dysphagia* occurred in nearly a third of my cases, *i.e.*, in 30·2 per cent. This symptom does not occur so frequently in any other chronic disease of the throat. The difficulty of swallowing is of three kinds. In the early stage it generally partakes of the character of *odynphagia*, being due to pain in swallowing. Later on there is often obstruction from the enlarged epiglottis and the swollen ary-epiglottic folds; whilst at a still more advanced period the difficulty of swallowing is due to the imperfect closure of the larynx, and the consequent passage into that tube of the ingesta.

*Sore throat*, that is to say, a feeling of soreness occurring independently of deglutition, was present in 12·4 per cent. of my cases.

*Cough* was a marked symptom in 427 of my 500 cases. Though nearly always present to a greater or lesser extent, it is not generally a prominent symptom in the early stage. It may be very slight and occasional, or it may be frequent and irritating—what is called "a tickling cough." In the later stages of the disease, however, there are often violent paroxysms of the most prolonged and exhaustive character.

*Shortness of Breath* occurred in 415 of my 500 cases. This symptom is partly due to the disorganized condition of the lungs, and partly to the inability to close the glottis. The latter condition has been described by Ziemssen[1] as phonative loss of breath. *Laryngeal dyspnœa* occurred in 2·2 per cent., necessitating tracheotomy in ·6 per cent.

*Expectoration* varies both in quantity and quality, and, in fact, depends more on the condition of the bronchial tubes and lungs than on that of the larynx.

Some of the *other phenomena* which accompany laryngeal phthisis are characteristic, the cachectic look of the patient being often very marked, even at the beginning of the disease. On *laryngoscopic examination*, the appearance of the organ is seen to vary considerably at different

[1] Loc. cit.

periods in the course of the malady, but generally has some special features by which its true nature may be recognized. In cases of pulmonary phthisis pallor of the mucous membrane is often noticed, and Dr. Semeleder first called attention to anæmia of the larynx as a frequent pre-tubercular condition of that organ. This view has since been maintained by Sawyer,[1] Solis Cohen,[2] Semon,[3] and others, and it is probable that feeble local nutrition predisposes to the deposit of tubercle. The existence of marked anæmia of the larynx should always induce the practitioner to make a careful examination of the apices of the lungs. It must not be forgotten, however, that in all anæmic and chlorotic states of the system the laryngeal mucous membrane participates, and it is only in the non-existence of other conditions that tubercle must be suspected. In any case, however, the anæmia often gives way to congestion —a congestion which is by no means characteristic or distinguishable from chronic catarrh. On the other hand, when the deposit of tubercle has taken place to some considerable extent, the appearance is often pathognomonic. The ary-epiglottic folds look like two large, solid, pale pyriform tumours, the large ends being against each other in the middle line, and the small ones directed upwards and outwards. The surface is, as already remarked, generally pale, but there may be accidental congestion. The inter-arytenoid fold is lost in these swellings, which interfere with the action of the arytenoid cartilages, and thus prevent approximation of the vocal cords. It must not be expected that this peculiar swelling of the ary-epiglottic folds will be found in every instance; but it will be met with in by far the greater number of cases, and when present is typical of laryngeal phthisis. The epiglottis may be thickened, but sometimes shows no signs of deposit. Such are the appearances which are typical of the first stage of laryngeal phthisis. In the second stage ulceration takes place, and the ulcers are almost always small and scattered. It will be observed that I only recognize two stages in laryngeal phthisis, viz., the first stage in which deposit takes place, and the second stage, in which ulceration occurs. It will, perhaps, simplify matters if the morbid changes in the separate parts are now described in detail.

[1] "Lancet," January 30th, 1875.
[2] "New York Med. Record," No. 26, 1878.
[3] "London Med. Record," April 15th, 1879.

*Ary-epiglottic Folds.*—Sometimes the ary-epiglottic fold of one side is alone affected (as in Fig. 77), and at an early

FIG. 75.—LARYNGEAL PHTHISIS, showing the pyriform swelling of the ary-epiglottic folds.

FIG. 76.—INCIPIENT LARYNGEAL PHTHISIS involving the left ary-epiglottic fold, but before the true pyriform swelling is developed.

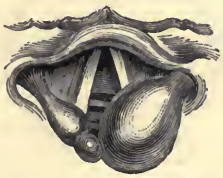

FIG. 77.—The same case more developed, showing one ary-epiglottic fold of the pyriform shape (as far as the woodcut is concerned the drawing might answer as well for œdema, as the density of the swelling cannot be shown).

stage the projection of the cartilages of Wrisberg and Santorini interferes with the distinctly pyriform shape of the tumours (Fig. 76), but when fully formed they are very characteristic of the disease. As the affection progresses, a certain amount of œdema is almost always superadded to the more solid deposit.

*Epiglottis.*—The epiglottis is not unfrequently thickened and ulcerated, and sometimes it is so much enlarged as to prevent an inspection of the parts below. In other cases, the valve assumes an altered position and covers the opening of

the larynx, a phenomenon which, as Dr. Krishaber[1] has pointed out, is often met with at quite an early period of the

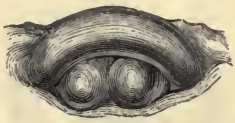

Fig. 78.—Laryngeal Phthisis, showing the turban-like thickening of the epiglottis and the swollen mucous membrane over the arytenoid cartilages.

Fig. 79.—Laryngeal Phthisis, showing great thickening, with scattered ulcers.

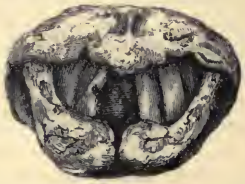

Fig. 80.—Laryngeal Phthisis, showing destruction of a large portion of the epiglottis, and general ulceration.

disease; at a more advanced stage its shape is often somewhat turban-like (Fig. 78), the normal contour and surface marks having completely disappeared. In addition to the thickening, the epiglottis is, in fact, often rolled backwards on itself, so that the free edges cannot be seen in the laryngeal mirror. In other cases where they are visible, the cartilage is exposed from ulceration (Fig. 80). Sometimes there is general thickening, with scattered points of ulceration (Figs. 79 and 80). The presence of a great number of small, scattered, and obstinate ulcers is indeed very characteristic of the disease.

[1] Loc. cit. p. 650.

*Ventricular Bands.*—Thickening and ulceration of the posterior part of the ventricular bands can sometimes be seen, but the disease may make considerable progress in this site without coming into the field of vision. By placing the mirror somewhat obliquely, and slightly twisting the patient's neck, ulcers in this situation can, however, be detected.

*Vocal Cords.*—Slight thickening of the vocal cords is an early phenomenon, and ulceration is very frequent, the most common position being at the *processus vocalis*. The elastic tissue is often exposed, and not unfrequently eroded.

In the most advanced stages of laryngeal phthisis, the ulcerative process often makes such ravages that the larynx becomes almost denuded of mucous membrane, whilst the greater part of the epiglottis is eaten away. At the same time perichondritis and destruction of the cartilages often occur. In the absence of the physical signs of pulmonary phthisis, it is not always possible to tell whether a case of laryngeal ulceration is tubercular or not, especially in the absence of marked infiltration. Though Ter Maten[1] and Türck have described the *laryngoscopic appearances of tubercle*, Heinze very properly declines to accept these observations, remarking that even in the case of a larynx fresh from the body, it is impossible to determine absolutely with the naked eye whether the ulceration is tubercular or not, although the matter can be easily settled with the microscope. Paralysis of one of the vocal cords is sometimes present, the right recurrent nerve being occasionally pressed on when the apex of the right lung is diseased (*see* Paralysis of the Recurrent Nerves), and the left being sometimes impinged on by an enlarged gland. These, however, are rare phenomena. More often the immobility of one of the cords is of a purely mechanical character, due to general infiltration of the tissues.

*Pathology.*—Secondary tubercular deposit in the larynx is a very common sequel to pulmonary phthisis. According to Heinze, the larynx is next most frequently affected after the intestines, but Willigk's statistics place the mesenteric glands as well as the intestines above the larynx. In Heinze's 1,226 cases of pulmonary phthisis, tuberculosis occurred in the following descending scale :—In the intestines, in 630 cases ; in the larynx, in 376[2] ; liver, 286 ; kidneys, 150 ; pleuræ,

[1] "Nederlandsch Tijdschrift voor Geneeskunde." Treede Afdeelig, 1865, p. 36.

[2] This is the number of cases of ulceration of the larynx ; about fifty of these, or 14 per cent., were probably non-tubercular.

137; spleen, 120; glands, 106; trachea, 99; peritoneum, 95; membranes of the brain, 43; sexual organs, 21; omentum, 21; tongue, 18; bronchi, 15; pharynx, 14; vesical organs, 12; brain, 12; pericardium, 11; tonsils, 8; mesenteric glands, 7; œsophagus, endocardium, supra-renal capsules, each 5; knee-joint, thyroid glands, outer coat of aorta, muscular substances of heart, of each 1. According to the statistics of Williglk,[1] made in the Prague Pathologico-Anatomical Institution, out of 1,317 cases of tuberculosis, there were 656 of the intestines, 237 of the mesenteric glands, 182 of the larynx, and 242 of other organs. The difference in these two sets of statistics is probably to be accounted for by the more careful microscopic examinations of Heinze.

The laryngoscopic appearances of laryngeal phthisis have already been described, but the broad features of the pathology must again be pointed out before the minute changes are detailed. Structural changes are often preceded by obstinate hyperæmia, which cannot be distinguished from chronic catarrhal laryngitis.

*Thickening of the tissues* constitutes, when due to the deposit of tubercle, the true first stage (that of deposit), and the amount of thickening varying in different situations, but the ary-epiglottic folds and epiglottis being more frequently infiltrated and swollen to a greater extent than any other parts; in the second stage small ulcers form, which afterwards coalesce and produce larger ulcers (the secondary tubercular ulcers of Rokitansky). Chronic œdema almost always accompanies or follows the tubercular deposit. In 500 cases of laryngeal phthisis which I examined during life, there was evidence of œdema 165 times. In many of these cases the observation was made in an early stage of the malady, and no doubt the tendency to œdema increases as the disease advances. Thus in 100 autopsies of laryngeal phthisis, œdema—circumscribed or general—was present in 71 instances. The following table shows the results, as regards thickening and ulceration, in the different parts of the larynx:—

TABLE E.

*Pathological results in 500 cases examined during life.*

| | Epiglottis. | Aryten. Cart. or Ary.-epigl. Fold. | Vocal Cords. | Vent. Band. | Inter-arytenoid Folds. |
|---|---|---|---|---|---|
| Thickening .. | 175 | 397 | 173 | 113 | 101 |
| Ulceration .. | 111 | 52 | 157 | 97 | 92 |

[1] "Prager Viertel jahrschrift," ii. 1856.

Thickening, either general or circumscribed, was present in every case; thickening with ulceration in 193 cases. In my 100 cases examined after death, however, I found ulceration in 97 cases, as will be seen from the annexed table:—

TABLE F.

*Post-mortem (naked eye) appearances of mucous membrane in* 100 *cases.*

| | Epiglottis. | Aryten. Cart. or Ary.-epigl. Fold. | Vocal Cords. | Vent. Band. | Inter-arytenoid Folds. |
|---|---|---|---|---|---|
| Thickening .. | 81 | 97 | 81 | 95 | 93 |
| Ulceration .. | 69 | 78 | 89 | 91 | 91 |

There was also necrosis, with separation of perichondrium by pus, in 15 cases; perichondritis (thickening of perichondrium) in 11 cases, without apparent separation of perichondrium; and ossification of cartilages in 79 cases.

Tubercular *infiltration*, according to Heinze, is present in about half the cases of laryngeal phthisis, but it has appeared to me to occur much more frequently. The deposit can often be recognized macroscopically as a smooth, elastic, yielding swelling of greyish-white or greyish-yellow colour, which on its surface frequently shows a whitish-yellow deposit, either collected in little masses or confluent. Microscopically the appearance is very characteristic. There is general thickening of the diameter of the mucous membrane (equally affecting both the mucosa and sub-mucosa), so that it becomes from three to four times its ordinary thickness. This is most conspicuous in the covering of the arytenoid cartilages, in the ary-epiglottic folds, and in the epiglottis. As regards the epithelium, until ulceration has actually taken place there is no great change, even when there is considerable deposit of tubercle beneath the epithelial structures—a circumstance which is opposed to the view that tubercular infiltration is due to the corrosive action of the sputa. The deposit consists of *tubercles*, which are made up of more or less circumscribed collections of cells of various shapes and sizes, having a somewhat concentric arrangement upon a scaffold of lymphoid reticulum. The tubercles, some very small, and some as large as a millet seed, have frequently, in their centre, a "giant cell," around which are lymphoid cells, and some few larger cells with nuclei of high refracting power. The tubercular deposit is found both in the mucosa and in the sub-mucosa, but always above the layer containing the mucous glands. It is sometimes deposited uniformly through the thickness of the mucous membrane, but

is much more commonly found in the most superficial layer of the mucosa, immediately beneath the epithelium. In the deeper layers of the mucosa both the tubercles and the round cells are less abundant. Occasionally we meet with deposits of tubercle near the epithelium, whilst the tissue between the deposit and the epithelium contains a few round cells and many capillary vessels, but no tubercle—a circumstance which further tends to show that the tubercular ulcer originates through perforation from *within*, not from without. The tubercle is of different date: sometimes it shows fatty degeneration at its centre, sometimes such complete caseation that only its walls remain.

In describing the microscopical appearances I have made large use of the valuable work of Heinze already referred to. Until the publication of his essay I had not given my attention to the minute histology of this important disease, but since then my brother, Dr. Stephen Mackenzie, has made careful microscopical examinations of my recent pathological specimens, and has furnished me with the following report, which it will be seen fully confirms Heinze's observations:—

"In the specimens submitted to me, the epithelium presents no important alterations. The mucosa and sub-mucosa are greatly swollen and œdematous, and infiltrated throughout with lymphoid cells, which occur both as a general infiltration and in more or less circumscribed collections with a somewhat concentric arrangement. These collections are supported by a delicate reticulum, and their centres are often pale and necrotic. The circumscribed collections of lymphoid cells frequently enclose two, three, or more large plates or spheres of protoplasm containing a great number of vesicular nuclei and delicate peripheral filamentous processes (giant cells). The appearances are, indeed, similar to that which is seen in tubercular diseases wherever occurring. In the laryngeal mucous membrane there appears to be a general infiltration (such as is commonly observed in chronic inflammation), associated with more or less well-defined and often coalescing tubercles. As regards the position of the latter, they occasionally appear to be placed laterally to arteries, but this may be only accidental, the irregular course of the vessels in the laryngeal mucous membrane not being favourable to tracing any relationship. Sometimes

[1] "Ueber pathol. Veränderungen d. Kehlkopfmuskulatur bei Phthisikern." Virchow's "Archiv," 71-73, 1877.

they are close to the dilated ducts of the mucous glands, which show some alterations. In parts both acini and ducts are dilated, and whilst containing small round cells, they are surrounded by a considerable amount of cellular infiltration. The tubercles occur at all depths from close beneath the epithelium to near the cartilages. None are free on the surface, except where it is ulcerated."

FIG. 81.—SECTION THROUGH THE RIGHT ARY-EPIGLOTTIC FOLD, SHOWING TUBERCLES IN SUB-MUCOSA.
*a* Tubercles. *b* Mucous Glands.

The *cartilaginous* framework of the larynx shows the effects of tuberculosis in various ways. Perichondritis is characterized by the abundance of pus cells between the bands of the perichondrium. The suppuration is sometimes so active that the whole structure may disappear, and the cartilage lie loose

in an abscess. The intercellular substance of the hyaline cartilages first becomes opaque, and afterwards shows signs of fatty degeneration, whilst the elastic fibres of the epiglottis become infiltrated with pus, and the cartilage cells disappear by fatty degeneration. According to Heinze, perichondritis only occurs when the tubercular process approaches the cartilages or reaches the perichondrium, neither perichondritis nor chondritis being ever met with in cases of catarrhal ulceration of the larynx. I feel convinced, however, that this view is incorrect, and that perichondritis occasionally

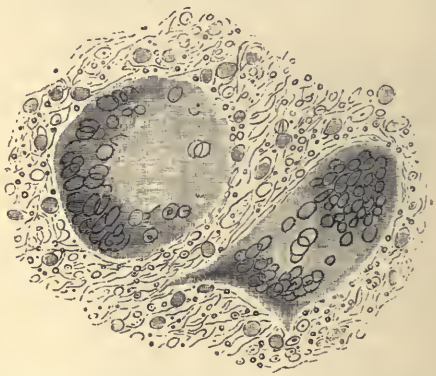

FIG. 82.—PORTION OF ONE OF TUBERCLES IN PRECEDING FIG. MORE HIGHLY MAGNIFIED TO SHOW GIANT CELLS.

supervenes in cases of long-standing but simple chronic laryngitis. Heinze maintains that the largest swellings met with in laryngeal phthisis are not due to perichondritis but to tuberculosis of the mucous membrane, and that in cases of perichondritis the tumefaction is often very slight.

*Ulceration* is the common sequel of the deposit of tubercle in the mucous membrane of the larynx. Friedreich has stated that the larynx is most frequently affected on the same side as the lungs, but I have not found this to be the case. On this subject Heinze remarks that during life it is impossible to be certain that the apparently sound lung is intact; and further, that on post-mortem examination it is rare to find the ulceration entirely confined to one side. In fifty cases of pulmonary phthisis, he observed *tubercular ulceration* of the larynx in forty cases, non-tubercular ulceration of the larynx (but tubercular ulceration of the

trachea) in seven, and three in which there was no tuberculosis. Tubercular ulceration is characterized by the presence of tubercles in the edges or bases of the ulcers, but ulcers must also be regarded as tubercular, even though no characteristic tubercle is present, when giant cells are found (either alone or associated with round cells) diffusely infiltrated in a reticular structure.

A few words are required as regards the special tissues of the larynx. Sometimes the tubercular process commences in the *glandulæ*, the deposit of round cells, in the interstices between the acini gradually encroaching on the membrana propria, and leading to the destruction of the acinous structure, so that a capsule which in a state of health would contain twenty or thirty acini is found holding only four or five of these bodies. At last the capsule is destroyed, and there only remain isolated portions of degenerate gland structure. The ducts of the glands have the greatest power of resistance, and are often found in the tubercular infiltration intact with perfect cylindrical epithelium. Tubercular ulcers commencing in the glands have been carefully described by Rindfleisch,[1] who observes that they begin at the mouths of the mucous glands, and in appearance are circular, and flat or funnel shaped, with narrow but extremely yellow borders. On section of the *arteries*, a mass of round cells is often found partly outside the adventitia, but for the most part amidst its fibres. Sometimes there is an abundance of tubercles, some recent and some of old date showing signs of caseation. In these cases the adventitia is generally destroyed, whilst the muscularis and intima of the arteries almost always remain intact. The muscularis of the *veins* is, however, much more easily destroyed, and the lumen of the vessels undergoes great modification and contractions. The *capillaries* show the same power of resistance as the arteries, their endothelial cells generally remaining unchanged, and their walls of normal strength. The capillaries are often found in excess between the tubercular deposit and the lower layer of the superjacent epithelial cells. Tubercle is very seldom detected within the *muscular structure*, but Fränkel[1] found the contractile substance the perimysium internum and corpuscles in a state of fatty degeneration. He states that the muscle-corpuscles were increased either in number or size in all the muscles he exa-

[1] "Lehrb. d. Path. Gewebelehre" iv. Aufl. 1875, p. 325.

mined. Heinze rarely met with changes in the muscular structure, but in two cases tubercles were present. Once a small fresh tubercle was found between the fasciculi, and once the deposit was in such abundance that only the section of two or three separated fibres remained in the midst of the tubercle. In a few cases Heinze found the muscle-corpuscles increased in number. It may be stated that these changes in the structure of the muscles are the results of chronic nutritive deviations, and not specially characteristic of the tubercular process.

*Diagnosis.*—Where the characteristic semi-solid pyriform swellings of the ary-epiglottic folds are present it is almost impossible to mistake the disease; but where the thickening is not of such a defined character the diagnosis is not quite clear. The examination of the lungs will sometimes confirm a doubtful diagnosis, and where auscultation yields negative results, a careful search should be made in the sputa for the elastic tissue of the lung.

The conditions which are most likely to give rise to an error are chronic laryngitis, chronic œdema, and syphilitic thickening or ulceration. In chronic laryngitis the swelling is generally much less than in laryngeal phthisis, whilst there is more hyperæmia; in œdema the much greater transparency of the swelling differentiates it from phthisis, though it must be admitted that in advanced laryngeal phthisis œdema is usually added to the tubercular infiltration.

In syphilis the thickening is very irregular, and the ulcers are generally large and solitary, and hence frequently unilateral; they are also commonly surrounded by an inflamed areola. In phthisis, on the other hand, the swelling is more smooth and uniform, whilst the ulcers are small, numerous, scattered, and situated on a pale ground. The two diseases differ also as to the parts they attack. Thus, when syphilis assails the epiglottis, it is the lingual surface and free edge which generally suffer; whilst in tubercular ulceration, though the free edge of the epiglottis is often attacked, it is the under surface and base which are more generally and more deeply affected. In both diseases the whole valve may be eaten away, but this result is seen far more often in syphilis than in phthisis. Ulceration over the arytenoid cartilages is comparatively rare in syphilis, but very common in tuberculosis, and the same observation is applicable to the ventricular bands and the anterior commissure of the vocal cords. Both diseases attack the vocal cords very frequently,

but while phthisis generally affects both vocal cords, in syphilis one cord alone is not uncommonly ulcerated.

The ulcerations in laryngeal phthisis may be extensive, but the actual loss of substance which takes place is not generally so great as in tertiary syphilis. For further observations on differential diagnosis, the reader is referred to the article on Syphilis, page 362.

Catarrhal ulcerations are nearly always very superficial, so that they have more the character of erosions, and are most common on the vocal cords. Non-tubercular ulceration may, of course, supervene in a person suffering from pulmonary phthisis, and such ulcerations may afterwards become tubercular through the deposit of tubercles.

*Prognosis.*—The prognosis of laryngeal phthisis is always extremely unfavourable, and it is not certain that any cases ever recover. Of all the cases of laryngeal phthisis that I have ever seen, I only know of four in which I have reason to believe that the disease was entirely arrested. In these instances—in all of which there was deposit in the lungs, and in one a cavity—the laryngeal signs of the disease disappeared, whilst those appertaining to the lungs remained stationary or retrograded. In considering the probable duration of life, the age and family history of the patient, the character and stage of the lung disease, the amount and kind of expectoration, the frequency of the pulse, the temperature of the body, the rate at which loss of weight takes place, are the main criteria. These various matters are discussed in detail in the text-books of medicine, and in monographs on phthisis, and it need only be remarked here that, as a rule, patients from eighteen to twenty-five years of age succumb most quickly, and that where there is a strong family predisposition to tuberculosis the fatal issue is sooner reached. Disease *within* the larynx is less rapidly fatal than when the morbid process attacks its *outer* portions; in other words, if the epiglottis, or ary-epiglottic folds are infiltrated or ulcerated the disease terminates more quickly than when the ventricular bands or vocal cords are the seat of the disease. This is accounted for by the fact that ulceration of the more exposed portions of the larynx interferes most with the act of deglutition, and hence favours marasmus. *Ceteris paribus*, the greater the amount of infiltration the more unfavourable the prognosis; and in cases in which there are numerous scattered ulcers, without much thickening of the mucous membrane, the progress is slower than where there is general infiltration,

The following is the duration of life (in months) after the throat-symptoms had begun to be troublesome in 100 cases subjected to post-mortem examination. It will be seen that in the greatest number of cases death occurred in from twelve to eighteen months, and that 66 per cent. occurred between six months and two years. Further, it is to be observed that very few patients lived more than two years and a half, and very few died before six months:—

TABLE G.

*Duration of life after throat-symptoms had become troublesome.*

| No. of Cases. | Duration of Life in Months. |
|---|---|
| 1 | 49 |
| 2 | 42 to 48 |
| 4 | 36 to 42 |
| 5 | 30 to 36 |
| 13 | 24 to 30 |
| 19 | 18 to 24 |
| 30 | 12 to 18 |
| 17 | 6 to 12 |
| 4 | 3 to 6 |
| 5 | under 3 |

*Treatment.*—The constitutional treatment must be the same as that commonly employed in tubercular disease of the lungs. As regards local remedies, the plan already recommended for chronic laryngitis sometimes gives relief—the application of mineral astringents, by diminishing the irritability of the mucous membrane, often quieting the cough. Of these I have found perchloride of iron (℥j. ad ℥j.) the most serviceable. In the early stages, Dr. Porter[1] has observed excellent results from local applications of a solution of sulphate of iron and ammonia. In some cases soothing inhalations of benzoin or hop act very beneficially. When the cough, however, becomes very troublesome, no treatment gives so much relief as the insufflation of morphia. One-eighth of a grain diluted with starch should be blown down twice a day, and as the disease advances the dose should be increased to ¼ or ½ a grain. It is important to get the larynx, as far as possible, cleared of the masses of mucus, which often cover it, before the powder is introduced; and the patient should endeavour not to cough for a few minutes after the application has been made. This treatment relieves the cough, and generally removes the distressing odynphagia, which, by pre-

[1] "Tubercular Laryngitis." "Trans. Missouri State Med. Assn." 1878.

venting the patient taking a proper amount of food, hurries on the fatal issue. The fact that the maximum local anæsthesia is obtained in rather less than an hour furnishes the indication for the time of administration of the powder in reference to taking food. When there is much œdema, scarification affords relief. These are the simple measures which, after trying many plans of treatment, I have been induced to adopt. Other physicians, however, have recommended various procedures, some of which may be here referred to. Thus Dr. Schnitzler[1] advises insufflation of nitrate of silver, or acetate of lead diluted with sugar of milk; whilst Dr. Marcet[2] recommends, as a local application, a solution of iodine in olive oil—twenty grains of iodine with five grains of iodide of potassium in an ounce of oil, and further advises that this iodized oil should be rubbed into the skin of the neck over the larynx. Dr. Marcet also advises scarification "in the swollen and indurated form of laryngeal phthisis." Believing that the tubercular process originates in a high state of local vascularity, which is "followed by an abnormal function residing in the tissue and exerted upon the blood," he considers "that by the puncture of the inflamed part, and the consequent relief of the vessels, fresh blood is admitted into the capillaries, and the normal vital force of the tissue is again called into action." In this way he supposes that the morbid process may be temporarily arrested; though, of course, the primary deposit may continue as a cause of irritation and inflammation. When, however, the mucous membrane is *extensively* infiltrated with tubercular deposit, Dr. Marcet thinks that scarification should be withheld. Dr. Krishaber[3] considers that cauterization with Vienna paste of the outside of the neck just over the thyroid cartilages, has often been productive of the best results. He directs that the wound should be kept in a state of suppuration for one or more months.

Where the patient can swallow to a slight extent, but experiences difficulty from food occasionally entering the larynx, he should be directed to take thickened liquids. A little arrowroot, corn flour, or isinglass, may be used for giving a proper consistence to the fluids. By thickening

[1] "Ueber Kehlkopfgeschwüre." Wien. Med. Presse. No. 14, u.f. 1868.

[2] "Clinical Notes on Diseases of the Larynx." London, 1869, pp. 94 and 135.

[3] Loc. cit., p. 673.

the drink it will be much less likely to pass beneath the edges of the epiglottis into the larynx. It is also well to direct the patient to take the drink at a draught—not to sip it. This mode of procedure makes the act of deglutition continuous, instead of intermittent, and under these circumstances the passage of food into the larynx is much less likely to occur. When the patient is unable to swallow at all, life may be often prolonged by feeding him with the œsophageal tube. As already pointed out, the dysphagia at this stage of the disease is generally due to the act of deglutition being imperfectly performed from non-closure of the larynx by the epiglottis, not to obstruction in the food-tract caused by the thickened epiglottis and arytenoid cartilages. It is from food "going the wrong way," not from the fact of its being prevented passing down the gullet, that the difficulty in swallowing arises. Hence there is generally very little difficulty in introducing the œsophageal tube. (See Œsophageal Instruments.) The fatal termination of phthisis is, of course, much accelerated if the supply of food is to a great extent cut off, and I may observe that I have prolonged life for many weeks by giving food and stimulants in the way described. Alcoholic liquids, which the irritability of the throat would not allow to pass, can be readily introduced into the system by this method. Nutritive enemata can be employed instead of the œsophageal tube, but the results of this method are less satisfactory.

If there is much dyspnœa tracheotomy should be performed, but the effect of the operation is, as a rule, only to prolong a miserable existence. I cannot recommend the operation as in any sense curative, and quite agree with Dr. Solis Cohen, who remarks[1] that "it cannot be curative, either directly or indirectly, and is only justifiable to ward off asphyxia from œdema, tumefaction, or impaction of necrosed cartilage." It is true that cases have been published by Dr. Serkowski[2] and Dr. Ripley[3] which are opposed to this view, but I cannot accept these cases as establishing tracheotomy as a curative operation in laryngeal phthisis. In one of Serkowski's cases the patient survived the operation three years, and after death the lungs showed evidence of far-advanced phthisis, but it is highly probable that the tubercular affection was developed long after the trachea had been

[1] "Diseases of the Throat." 2nd Edition, New York, 1879, p. 516.
[2] "Allgem. Med. Chi. Zeitung." Aug. 1878.
[3] Beverley Robinson: Op. cit.

opened; and in his other case there is no proof that the patient was really suffering from laryngeal phthisis. In Dr. Ripley's case the operation certainly prolonged the patient's life, but was in no sense curative. In opposing tracheotomy in laryngeal phthisis, except when there is urgent dyspnœa, I differ entirely from my accomplished pupil Dr. Beverley Robinson, who observes that in order "to obtain these latter (*i.e.*, favourable results) it seems indicated not to delay the operation, but rather to perform it so soon as the nature of the disease is obvious, and other means appear of no avail." During the last twenty years I have performed tracheotomy in a few cases of laryngeal phthisis—perhaps a dozen—but, although it has often relieved urgent dyspnœa, I cannot recall a single instance in which the operation delayed the pathological process. Far from giving rest to the larynx, the wearing of a canula, in my opinion, tends to irritate the windpipe.

## PERICHONDRITIS OF THE LARYNX AND NECROSIS OF THE CARTILAGES.

*Latin Eq.*—Perichondritis laryngea et Necrosis cartilaginum.
*French Eq.*—Perichondrite laryngée et Necrose des cartilages.
*German Eq.*—Entzündung des Perichondriums des Kehlkopfs und Necrose des Knorpels.
*Italian Eq.*—Pericondrite della laringee. Necrosi delle cartilagini.

DEFINITION.—*Inflammation of the perichondrium of the larynx, and necrosis (or, more strictly speaking, caries) of the cartilages, the latter being generally dependent on the former. In slight cases the morbid process is no doubt often arrested, slight enlargement of the cartilage remaining, whilst in syphilis extrusion of a part or whole of the affected cartilage may take place; in other cases, however, when an abscess forms, hectic fever almost invariably supervenes and death follows.*

*History.*—This affection was first described by Hormann[1] in

[1] "Von einer in Vereiterung übergehenden Halsentzündung Sammlung auserlesener Abhandlungen." Leipzig, 1791. Ryland has been referred to by some authors as having mentioned the subject of the disease of the cartilages of the larynx, but he only describes one case in which dysphagia was said to occur from premature ossification of the cricoid and arytenoid cartilages.

1791, and Albers[1] gave a somewhat fuller account of the disease fifty years later, but Rühle first described it in detail. Dittrich,[2] Pitha,[3] and Wilks [4] subsequently reported cases, but it was only when diseases of the larynx began to be investigated with the laryngoscope that any considerable attention was devoted to the subject. Since then, cases have been published by Türck,[5] Retslag,[6] Scheck,[7] Gerhardt,[8] Schroetter,[9] myself,[10] and the subject has been treated by Ziemssen [11] with his usual ability.

*Etiology.*—The disease is most common between the ages of twenty and forty, and the fact that it occurs very frequently as a sequel to laryngeal phthisis accounts for the greater incidence of the affection at that period of life. I have notes of its occurrence in forty-five autopsies; but I have met with it during life in many other cases, especially in phthisis and syphilis. Men are more subject to the disease than women, and in the forty-five autopsies thirty-three of the subjects were males and twelve females. The following table gives some information as regards the ages of the patients :—

FORTY-FIVE AUTOPSIES,

*In which Necrosis of the Cartilages was present.*

| AGES. | | | | | |
|---|---|---|---|---|---|
| From | 10 | to | 20 | years | 0 |
| ,, | 20 | to | 30 | ,, | 16 |
| ,, | 30 | to | 40 | ,, | 11 |
| ,, | 40 | to | 50 | ,, | 9 |
| ,, | 50 | to | 60 | ,, | 5 |
| ,, | 60 | to | 70 | ,, | 4 |

In three non-fatal cases the disease affected the upper part of the alæ of the thyroid cartilage (two the right plate and one the left plate), and there were small external abscesses in the neck. I have also seen the disease during life in four cases of cut-throat. In the forty-five autopsies (see Pathology, page 391), nineteen occurred in laryngeal phthisis, ten in carcinoma, six in tertiary syphilis, four in typhoid fever, two in chronic laryngitis, and three were examples of

[1] "Einige Krankheiten der Kehlkopfsknorpel," "Gräfe und Walther's Journal d. Chirurg. und Augenhlk," xxix. 1840.
[2] "Prag. Viertelj." iii. 1850.
[3] Ibid.: Bd. i. 1857.
[4] "Trans. Path. Soc." 1858.
[5] "Wien. Mediz. Zeit." 1861, No. 50; and 1863, No. 9.
[6] "Ueber Perichondritis Laryngea." "Dissertatio." Berlin.
[7] "Intelligenzblatt." 1872, No. 23.
[8] "Archiv f. Klin. Med." Bd. xi. p. 24.
[9] Loc. cit. 1871.
[10] "Trans. Path. Soc." vol. xxii.
[11] "Cyclop. of the Prac. of Med." vol. vii. p. 814.

primary chondritis. These cases of primary inflammation of the cartilage all occurred in patients over sixty years of age; two were men and one a woman. One of them suffered from gout in the hand. My statistics, however, are not at all reliable as regards the relative frequency of perichondritis in different affections, for whilst I see many cases of phthisis, cancer, and syphilis of the larynx, I scarcely ever meet with typhoid fever; indeed, all the cases of that disease in which I found disease of the cartilages came under my notice formerly at the time that I was physician to the London Hospital. Retslag's statistics are based on post-mortem examinations at the Pathological Anatomical Institution at Berlin, and are of more value for illustrating the proportionate frequency of the primary diseases. In his experience, out of twenty cases of perichondritis, tuberculosis was the cause ten times, typhoid fever eight times, suppurative pleurisy once, and myelitis once. As a primary phenomenon the disease is very rare. But in addition to the cases which have occurred in my own practice, Türck [1] and Schroetter [2] have recorded examples. Rauchfuss [3] has also reported a case in a child three years old.

The idea of Dittrich [4] that the disease arises from ossification of the cricoid cartilage, leading to pressure of the soft parts against the vertebral column and subsequent perichondritis is probably erroneous. In the three cases of disease of one of the alæ of the thyroid cartilage the patients were all markedly scrofulous, and I believe in these instances that the abscesses in the neck led to exposure of the cartilage and ultimately to its necrosis.

*Symptoms.*—The symptoms of *primary* chondritis are more marked than those of secondary inflammation of the cartilage. Dull aching pain, sometimes felt in the larynx and sometimes in the pharynx, with difficulty of swallowing, was present in each of my three cases, and after the abscess burst, the breath was very fœtid. It must be borne in mind that in my cases it was the cricoid cartilage which suffered in every instance. In the *secondary* disease there is generally so much œdema that it is impossible to be certain as to the condition of the cartilages during life. The tumefaction in these cases usually even masks the ulceration which is almost invariably present. If, however, an ulcer be visible, a probe will generally detect the broken-down cartilage. Occasionally acute perichondritis is

[1] "Klinik." &c. p. 207, et seq.
[2] Loc. cit.
[3] Loc. cit. p. 243.
[4] Loc. cit.

followed by general emphysema, and examples of this accident are recorded by both Wilks and Ziemssen. The symptoms vary according to the cartilage affected. A necrosed *arytenoid* cartilage can, indeed, sometimes be seen through the ulcerated mucous membrane, but when it has been expectorated its absence is not always apparent. In the annexed cut (Fig. 83)

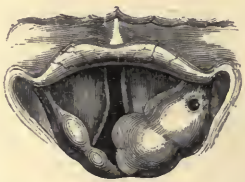

Fig. 83.—Perichondritis: Laryngoscopic Appearance after Expectoration of Right Arytenoid Cartilage.

the appearance of the ary-epiglottic fold is shown after the left arytenoid cartilage had been expectorated. Even partial destruction of this cartilage generally causes complete immobility of the corresponding vocal cord, probably by giving rise to anchylosis. Necrosis of the posterior plate of the *cricoid* cartilage, according to its extent, gives rise to paralysis of one or both of the posterior abductors of the cords. In my three cases of primary chondritis, the mucous membrane over the arytenoid cartilage and the upper part of the cricoid cartilage was observed to be constantly covered with pus, but in no instance was the opening of the abscess seen during life, probably owing to its orifice being on a posterior surface of the cricoid cartilage. The symptoms of necrosis of the *thyroid* cartilage depend on whether the disease be *intra* or *extra-laryngeal*. I do not think that internal disease of the thyroid cartilage can be diagnosed with certainty. In the two cases that I have met with, the necrosis affected the inter-thyroid plate, and was only discovered after death. When the disease communicates externally with the neck, the necrosed cartilage can be easily felt with a probe. In two of my three cases I was able to inject milk into the larynx through the fistulous track. In a similar instance Professor Ziemssen also succeeded in injecting a coloured fluid, and Schroetter passed a probe through the fistula into the larynx, which became visible in the laryngeal mirror. The following statement shows the number of times each cartilage was affected in various diseases.

NECROSIS OF THE CARTILAGES IN FORTY-FIVE AUTOPSIES.

| | | | |
|---|---|---|---|
| Cricoid, in laryngeal phthisis (6 alone, 4 with arytenoid.) | .. .. | 10 | |
| ,, syphilis | .. .. .. | 1 | |
| ,, cancer | .. .. .. | 3 | |
| ,, typhoid | .. .. .. | 4 | |
| ,, primary | .. .. .. | 3 | |
| | | | 21 |
| Arytenoid, in laryngeal phthisis (11 alone, 4 with cricoid.) | .. | 11 | |
| ,, syphilis (5 times 1 cartilage, once both cartilages). | .. | 5 | |
| in cancer | .. .. .. | 6 | |
| ,, in chronic laryngitis (lungs healthy.) | .. | 2 | |
| | | | 24 |
| Thyroid, in laryngeal phthisis | .. | 2 | |
| ,, cancer | .. .. .. | 1 | |
| | | | 3 |

*Diagnosis.*—Primary chondritis or primary inflammation of the investing membrane may be suspected in the earlier stages of the disease when there is a dull, aching, or boring pain, with enlargement of some portion of the framework of the larynx, but without much hyperæmia of the mucous membrane. At a later period the soft tissues generally become involved, and the action of one or both the vocal cords impaired. There is also often a fœtid discharge. In secondary inflammation of the perichondrium its condition is often masked by the swelling of the mucosa and submucosa, but perichondritis may be surmised if, in the absence of cicatricial contractions, there is much distortion of any part of the larynx. When there is deep ulceration a probe can very often be passed through the opening, and the necrosed cartilage at once recognized.

*Pathology.*—In secondary inflammation of the cartilages, which, as already shown, is much the most common form, the morbid process almost always commences in the perichondrium. The fibrous investment of the cartilages becomes thickened, its individual fibres are separated and enlarged, and pus forms between them. At a later period a purulent collection takes places beneath the membrane, which thus becomes separated from the cartilage, and the latter, deprived of its vascular supply, undergoes molecular death. The affected cartilage is often of a dark grey, or even black colour. The presence or absence of discoloration seems to depend on whether there is communication,

through ulceration of the tissues, between the cartilage and the atmosphere. Where this communication does exist, as is most frequently the case, the surface, and sometimes even the entire thickness of the cartilage, is discoloured. On microscopic examination at the earliest stages the cartilage corpuscles are found to be broken down, and they ultimately disappear by a process of fatty degeneration. The intercellular substance first becomes thickened and opaque, and subsequently undergoes a retrograde metamorphosis of the fibres into purulent matter. Occasionally the cartilages appear to undergo a kind of molecular absorption, and then seem greatly atrophied. An example of this condition is figured by Rühle.[1] In secondary inflammation of the cartilages the tissues around the perichondrium are always greatly swollen and saturated with pus or serum.

*Prognosis.*—The prognosis is very unfavourable as regards life except in very slight cases, in those of traumatic origin, traumatic cases, or where syphilis is the cause of the disease. In the latter cases, although the morbid process may be arrested after tracheotomy has been performed, contraction of the laryngeal canal generally takes place, and this affection, though it can be palliated, is seldom cured.

*Treatment.*—In the acute stage of the disease little can be done in the way of treatment, except to relieve as far as possible the hyperæmia or œdema of the superjacent tissues. The former condition is met by the usual warm soothing inhalations, the latter by scarification. Should primary disease of the cartilages be diagnosed, two or three leeches should be applied to the neck, as nearly as possible over the seat of the affected cartilage, and repeated every other day, until either some beneficial effect is produced or the treatment appears useless. Tracheotomy often becomes necessary, and even in phthisis the patient's life may be prolonged by the operation. Where the posterior plate of the cricoid cartilage is the seat of the disease, the patient may be fed by means of the œsophageal tube; in one of my cases the patient, who was quite unable to swallow a drop of fluid, was kept in a state of perfect nutrition for nine weeks by this mode of feeding.

In cases of syphilis and cut-throat, or in any condition where the inflammatory process is arrested, dilatation of the contracted laryngeal passage may be subsequently effected, and there are various mechanical measures which may be resorted to. Since the year 1862 I have used an instru-

[1] Loc. cit. p. 1.

ment for this purpose (see page 261), but must confess that the results have been disappointing. The thickening of the cartilages, and in some cases the collapse of the cartilaginous frame-work from the falling inwards of its walls, the density of the cicatrized tissues in syphilis, and the constant tendency which these fibrous structures show to re-contract, render treatment very tedious, and a relapse generally follows as soon as mechanical treatment is discontinued. In order to meet the many difficulties which these cases present, Professor Schroetter,[1] of Vienna, has devised and carried out a method by which he has in many cases greatly increased the size of the trachea, and in some instances has enabled the patient to dispense altogether with the canula.[2] Dr. Labus, of Milan,[3] has also completely succeeded in one case.

In the first stage of treatment, Professor Schroetter employs catheters and rigid vulcanite tubes of graduated sizes, bent at a convenient angle for introduction into the larynx; the latter taper somewhat towards the point, so that they can be gradually worked into the stricture by the use of a moderate amount of force, and being open at both ends breathing is not obstructed during the operation. In order to prevent the patient from blowing or coughing particles of mucus into the face of the operator, a short piece of curved tubing, which can be turned in any direction, is fitted to the proximal end of the dilating tube. When the calibre of the canal has been increased to about the size of a No. 15 bougie, the second stage of treatment commences, and this constitutes, in fact, the distinctive feature of Schroetter's method. In order to effect any permanent dilatation of the stricture, it is requisite that the cicatricial tissue should be put on the stretch, or the collapsed cartilages kept apart, for several hours daily, and it need scarcely be observed, that on account of the irritation which would be set up in the pharynx and the consequent nausea it would be impossible for any patient to retain a large staff in his larynx, passing out through the mouth, for more than a few minutes at a time. With the view of meeting this difficulty, Schroetter devised the plan of using pewter plugs, of various diameters, and about an inch and a quarter in

[1] "Beitrage zur Behandlung der Larynx Stenosen." Vienna, 1876.
[2] Private communication from Professor Schroetter.
[3] "Il caterismo et la dilatazione meccanica nelle stenosi della laringe." Milano, 1876.

length, which being introduced into the larynx are retained *in situ* by means of the tracheal canula (Fig. 52). As they neither interfere with deglutition nor respiration, with a little practice the patient becomes able to wear these plugs for the greater part of each day. The various circumstances under which this process of dilatation can be carried out have been well described by Dr. Hack [1] in a recent lecture.

In some cases dilatation can be effected from below, that is by passing plugs up from the tracheal opening. Professor Gerhardt [2] has reported a case cured in this way, but I have rarely found it practicable, and never permanently successful.

## LUPUS OF THE LARYNX.

*Latin Eq.*—Lupus laryngis.
*French Eq.*—Lupus du larynx.
*German Eq*—Lupus des Kehlkopfs.
*Italian Eq.*—Lupus della laringe.

DEFINITION.—*Lupus* (*pathologically, similar to the same disease when occupying the skin of the nose*) *affecting the larynx, either primarily or secondarily.*

*Etiology, &c.*—Lupus of the larynx is a rare disease, and but few authors make any mention of it whatever. Türck,[3] however, has met with five cases, Tobold [4] with two cases, and Ziemssen,[5] Grossman,[6] and Lefferts,[7] have each reported one case. The last-named author believes, indeed, that the malady, if sought for in cases of cutaneous lupus, would probably be more frequently found than is generally supposed. I have myself met with only two examples, which are hereafter reported (p. 396, et seq.). The causes of the affection are not better known than those of ordinary lupus, with which it is identical except in site, but it probably originates in some constitutional defect which is either of the same nature as scrofula or closely allied to it.

[1] Volkmann's "Sammlung Klin. Vorträge," No. 52.
[2] "Archiv. für Klin. Med." Bd. xi. p 578.
[3] "Zeitsch. d. Gesellsch. d. Aerzte zu Wien," 1859, No. 11.
[4] "Kehlkopfkrankheiten," p. 307.
[5] "Cyclopædia of Med." vol. vii. p. 848.
[6] "Wien. Med. Zeitung," 1877, No. xx.
[7] "American Jour. of Med. Sci." April, 1878.

*Symptoms.*—The subjective phenomena of lupus of the larynx are in no way characteristic; in the early stages the patient generally complains, as in many other affections of this part, of slight sore throat and difficulty of swallowing, whilst, if the disease advances, there is often considerable dyspnœa. There is usually some hoarseness, and occasionally complete aphonia. Very frequently lupus is observed at the same time on some part of the face. On laryngoscopic examination the morbid appearances are marked, but still not of so peculiar a kind as to enable the observer at once to recognize the disease; for it offers some points of resemblance to syphilis, cancer, and phthisis, and these three affections must therefore be excluded by a careful investigation of the general condition and history of the patient. In Türck's cases there were ulcers on the epiglottis with loss of substance, chiefly in the form of a heart-shaped piece eaten out of the middle, as in my case here appended. In several instances growths have been noticed on the anterior surface of the posterior wall of the larynx. These appear as fleshy elevations of variable size, some of which have an irregular, jagged outline, whilst others are almost spherical. In Lefferts' case the epiglottis was covered with small fleshy tubercles and worm-eaten ulcerations, and in one of my cases (Fig. 85) half the valve was studded with molluscum-like projections. Sometimes the mucous membrane of the pharynx is merely thickened, but the greater part of the hard and soft palate and uvula may be covered with reddish fleshy wart-like growths, and the pharynx extensively ulcerated.

*Pathology.*—According to Virchow [1], the usual anatomical condition found in lupus of the larynx is presented by the following description of a case examined by him: An indurated cicatrix beset by thick knobs as large as a pea, extended from the middle of the dorsum of the tongue deeply down into its roots. The epiglottis was excessively hard, and was bordered by hard warts. From this part the tissues were hardened in a knotty manner as far down as the trachea. The arytenoid cartilages were deeply ulcerated, and surrounded by hard papillary outgrowths. According to the same investigator the lupus nodules are composed of a young and soft granulation tissue, which is usually very vascular. It contains small round cells, and originates in

[1] "Die krankhaften Geschwülste," Bd. ii. p. 490.

proliferation of the connective tissue, and not of the epithelium. The ultimate tendency of the morbid action is towards destructive ulceration, and in apparent healing, instead of a healthy and permanent cicatrix being produced, a tissue of low vitality is formed which is soon followed by a fresh outbreak of the disease in the same spot.

*Diagnosis.*—Lupus of the larynx is easily recognized when the characteristic skin affection is also present. In young subjects, also, there is not likely to be much difficulty in deciding as to the nature of the disease, except in cases of hereditary syphilis. When the laryngeal malady constitutes the only local manifestation of the disease, a careful investigation of the history and general condition of the patient must be made before arriving at a conclusion; if the question of syphilis arises, it will soon be settled by the administration of iodide of potassium.

*Prognosis.*—The generally intractable nature of lupous ulceration of the face is well known. Once established, the disease may last for the lifetime of the patient, entirely unrestrained by any means, surgical or therapeutic, that may be adopted for its cure. In the larynx, lupus does not usually appear to be a very dangerous affection, but occasionally the new formation is so abundant as to block up the glottis and necessitate tracheotomy, or the continued impediment to respiration may make a serious inroad on the constitution of the patient. The progress of disease in the larynx, however, appears, as a rule, to be very slow, and the malady is occasionally arrested.

*Treatment.*—Internally cod-liver oil should be administered, and, if the disease is active, its progress may sometimes be arrested by caustic applications. The solid nitrate of silver is the best remedy that can be employed for this purpose, but its effects should be carefully watched, and too extensive a cauterization of the diseased surface at one time should be carefully avoided. It may here be mentioned, however, that in Dr. Lefferts' case, caustics were so badly borne that he was obliged to resort to "much milder treatment, in which a modified Lugol's solution and sedative applications played an important part, to the great comfort of the patient, but without amelioration of the local pathological changes."

## CASES ILLUSTRATING LUPUS OF THE LARYNX.

In March, 1869, I was requested by my colleague, Mr. Cooper, at the London Hospital, to see Thomas P., aged fourteen, on account of

difficulty of swallowing. I found him suffering from destructive ulceration of the alæ of the nose, and from thickening and extensive ulceration of the lips. Between the nose and the mouth there was a dense white cicatricial tissue. The history of the case was that the nose became swollen nine years previously, and that after a fortnight ulceration appeared, which rapidly destroyed a portion of that organ and spread down to the lips. The patient stated that he had been in Guy's Hospital on several occasions, and that nitric acid had been applied under chloroform five times. This treatment resulted in healing of the tissues between the nose and the lips, but he had still an open ulcer involving the right ala of the nose and the septum, and nearly the whole of the superior margin of the upper lip, and for this he had applied to the London Hospital. The patient had a thick and slightly nasal voice, and complained that in swallowing "things often went the wrong way." A careful examination was made with a view of discovering any trace of syphilis or phthisis, but the lungs were perfectly healthy, and Mr. Cooper informed me that iodide of potassium had produced no effect whatever. The pharynx and posterior nares were seen to be healthy, but on laryngoscopic examination the epiglottis was found to be generally thickened, and to be ulcerated in the centre and along its free edge; the ary-epiglottic folds were also slightly swollen (Fig. 84). There was nothing at all

FIG. 84.—LUPUS OF THE LARYNX, SHOWING THICKENING AND ULCERATION OF THE EPIGLOTTIS.

characteristic of lupus about the epiglottis, and had the patient not been suffering from lupus of the face, I should certainly have attributed the laryngeal affection to tertiary syphilis. In view, however, of the facial phenomena, I felt no doubt that the thickening of the epiglottis was due to lupus. I saw the patient two years later, and found that under Mr. Cooper's treatment, consisting principally of the local applications of strong nitric acid, and the internal use of cod liver oil, the cutaneous ulcerations had ceased except at the left side of the mouth, where there was still a small ulcer. The larynx was in the same condition as when I first saw it, the ulcer neither having healed nor increased.

Elizabeth B., a native of Cork, aged eighteen, applied to me in June, 1877, on account of difficulty in swallowing and slight hoarseness. The whole of the left side of the nose to the inner canthus of the left eye had been destroyed by ulceration which had lasted six years, but had now healed up except at the cartilaginous portion of the septum. The patient stated that some years previously, in one of the Dublin hospitals, a strong acid had been applied to her face, and had done her a great deal of good. On examining the throat, the uvula was found to be greatly thickened and elongated, measuring, as nearly as possible, two centimetres, both in length and breadth; the

posterior pillars of the fauces were so much thickened that they were each about as broad as a man's thumb, leaving only a narrow space (about half a centimetre) of the posterior wall of the pharynx visible. On making a laryngoscopic examination, the epiglottis was seen to be enlarged, pendant, and immobile, its right side being covered with molluscum-like growths, and its centre occupied by a smooth and slightly depressed cicatrix (Fig. 85). Owing to the

FIG. 85.—LUPUS OF THE LARYNX, SHOWING MOLLUSCUM-LIKE GROWTHS ON THE EPIGLOTTIS.

general tumefaction, only a portion of the arytenoid cartilages could be seen; the mucous membrane over them was slightly swollen. This patient was treated by large doses of iodide of potassium and the insufflation of bismuth powder for six weeks without any effect; she subsequently remained under observation for seven months, during which time various local remedies were used, but without my being able to notice any change in the pharynx or larynx.

## LEPROSY OF THE LARYNX.

(SYNONYM: ELEPHANTIASIS GRÆCORUM.)

*Latin Eq.*—Lepræ veræ laryngis.
*French Eq.*—Lèpre du larynx.
*German Eq.*—Aussatz des Kehlkopfs.
*Italian Eq.*—Lepra della laringe.

DEFINITION.—*An infiltration of the laryngeal structures by a tubercular granulation-tissue, generally leading to destructive ulceration of the part. The disease occurs only as a concomitant of general leprosy.*

*Symptoms.*—The investigations of Virchow [1] have shown that even in the Middle Ages hoarseness and dyspnœa were so generally regarded as the signs of leprosy, that the possession of a "*vox rauca*" was almost sufficient to cause an individual so afflicted to be stigmatized as a leper. Since the introduction of the laryngoscope several practitioners who have

[1] "Die krankhaften Geschwülste," Bd. ii. p. 519.

met with general leprosy have endeavoured to ascertain the condition of the larynx by actual inspection. Amongst these Wolff,[1] Gibb,[2] Schroetter[3], and Elsberg[4] have furnished us with the most systematic observations, and I am now able to add three cases. Wolff, at Madeira, found chronic catarrh of the larynx, with considerable swelling, and vascularity of the epiglottis. The mucous membrane of the arytenoid cartilages and the ventricular bands was of a dark bluish-red colour, much thickened and apparently loosened from the sub-mucous tissue. The vocal cords were thickened, and of a yellowish-red hue. In addition, small papillary growths were present in different parts of the larynx, but rarely on the vocal cords. At the same time muscular pareses, interfering with phonation and respiration, could be detected by the laryngoscope. In Gibb's case there was great loss of substance of the epiglottis and vocal cords, together with a large amount of thickening of the other parts of the larynx. Schroetter found isolated tubercles, or uniform thickening of the various tissues of the larynx. In some cases laryngeal stenosis was developed to such an extent that the calibre of the canal was reduced to the diameter of an ordinary lead pencil. In Elsberg's cases the epiglottis was enormously thickened and covered with tuberous masses, whilst smaller growths occupied the ary-epiglottic folds. In my cases there was generally thickening of the epiglottis, and in one instance there was considerable œdema of the valve, and two small ulcers near its centre (Fig. 86), but in no instance did I meet with distinct tubercles.

*Pathology.*—According to Virchow[5] the pathological process in leprosy of the larynx consists in a development of tuberculous granulations on the mucous membrane, which are scarcely distinguishable from syphilitic condylomata or follicular abscesses. They possess, however, much more hardness and vascularity. In some cases tubercles are not present, but a greyish-white non-ulcerating infiltration of the mucosa and sub-mucosa. The tendency is towards ulceration, but the course of the disease is so extremely slow that in some cases, though progressive, it never

[1] Virchow's "Archiv." Bd. xxvi. p. 44, 1863.
[2] "Diseases of the Throat," p. 272. London, 1864.
[3] "Laryngologische Mittheilungen," ii. p. 84, 1874.
[4] Elsberg and Rice: "New York Med. Record," vol. xv. No. 1.
[5] Loc. cit.

attains this stage.[1] In Virchow's cases the base of the ulcerations was formed by indurated tendinous tissue, which penetrated deeply into the surrounding structures. The extraneous granulation-tissue bears a close resemblance to the new formations of lupus, and consists microscopically of simple spindle-shaped and stellate connective-tissue cells. By active division of the cells and nuclei the inter-cellular substance soon becomes almost obliterated or absorbed, until all the normal components of the part disappear. The morbid cell infiltration has a considerable proliferative character, the individual cells being round, pale, slightly granular, easily destructible, and usually possessing a rather large granular nucleus and a nucleolus. The great majority of these cells are superior in size to red blood corpuscles, some attaining the dimensions of the largest mucous corpuscles.

*Diagnosis.*—The diagnosis of laryngeal lepra is simple, the internal malady never occurring except as a concomitant of the more pronounced forms of general lepra.

*Prognosis.*—The prognosis is unfavourable, the laryngeal phenomena often constituting only a small part of an extensive and terrible disease of the cutaneous system.

*Treatment.*—It would be futile, in the present state of our knowledge, to discuss any measures for the radical cure of the disease. The various local phenomena must be treated according to the general rules laid down in the articles on Chronic Laryngitis and Œdema of the Larynx. If the dyspnœa is urgent tracheotomy must be performed.

## CASES ILLUSTRATING LEPROSY OF THE LARYNX.

George L., aged eighteen, sent to me by Mr. Erasmus Wilson, December 4, 1865. The face of the patient and the soles of his feet are covered with small round shining tubercles. The same condition exists to a less extent on the palms of the hands. The patient's voice is strongly nasal, and the mucous membrane of the nares so thickened that both the anterior and posterior nasal passages are nearly completely obstructed. The epiglottis is very much thickened, but there are no distinct tubercles and no ulceration. There is no difficulty in swallowing.

H. E., aged twenty-seven, a Norwegian sailor, from Bergen, whose ship is in the London Docks, came with his brother (see next case) to the London Hospital in February, 1869, on account of difficulty of breathing and swallowing. His forehead and right eyebrow were

[1] Thomas: "Beiträge z. path. Anat. d. Lepra Arab." Virchow's "Archiv." Bd. lvii. p. 455, 1873.

covered with soft, shining, yellowish-brown, irregular, but generally round or oval, tumours, varying in size from a pea to a marble. The right ear was much swollen and of purple colour. The pharynx showed slight thickening of the right side, especially of the right posterior pillar, which projected centrally as far as the uvula, and blocked up the view of the posterior nares. The epiglottis was greatly thickened and œdematous, especially on the left side, and

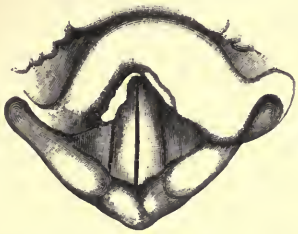

FIG. 86.—LEPROSY OF THE EPIGLOTTIS, SHOWING GREAT THICKENING AND SLIGHT ULCERATION.

there were two small ulcers on the free edge of the valve near its centre. There were, however, no distinct tubercles.

A. E., aged twenty-five, brother of the last patient, and like him a sailor. Nose and lips swollen, and covered with small round shining tubercles. Hair had fallen off eyebrows and beard. Had a hoarse voice but no difficulty of swallowing. Papilla at back of tongue enormously hypertrophied. Uvula thickened; three small ulcers on posterior wall of pharynx. Laryngoscopic appearances: A slightly congested and highly succulent condition of the mucous membrane of the larynx. No ulceration nor tubercles.

## FRACTURES AND DISLOCATIONS OF THE LARYNX.

*Latin Eq.* — Fracturæ cartilaginum laryngis. Laxaturæ laryngis.

*French Eq.*—Fractures et luxations des cartilages du larynx.

*German Eq.*—Fracturen und Verrenkungen der Kehlkopfsknorpel.

*Italian Eq.*—Fratture e lussazioni delle cartilagini della laringe.

*Fractures.*—These injuries are of unfrequent occurrence, but nevertheless certain authors have succeeded in collecting a considerable number of cases from various sources.[1]

[1] See Gurlt: "Handbuch der Knochenbrüche," p. 316; also Hénoque: "Gazette Hebdomad." 1868, No. 39, 40.

In 1868 Hénoque[1] published a monograph based on the consideration of fifty-two cases, which comprised all that had previously been recorded by medical writers. It appears that the larynx cannot be fractured by concussion unless it is supported to some extent on the vertebral column, as when the body is supine—the mobility of the organ and the elasticity of its cartilages, when the neck is not fixed, preventing a direct blow from producing more than a contusion of the soft parts.[2] In garrotting, the larynx is often fractured, not by pressure backward against the vertebral column, but by lateral compression of the wings of the thyroid cartilage. It is probable that ossification of the cartilages renders the larynx more brittle and liable to break under the influence of violence. As Dr. Panas judiciously observes,[3] a premature senility, whether produced by alcoholism or otherwise, predisposes the cartilages to suffer from the effects of injuries. The thyroid is the cartilage most usually fractured, whilst in those cases where the cricoid suffers, the injury is generally more extensive and dangerous. An analysis of Hénoque's cases, so far as the cause and exact seat are definitely stated, shows that 15 resulted from violent manual compression, 26 from falls, accidents with machines, and rolling vehicles, 4 from hanging, whilst 5 occurred in lunatics in some unexplained way through the wearing of the strait-waistcoat. In 23 instances the thyroid alone was fractured, in 7 the cricoid alone, and in 7 both these cartilages, whilst in the remaining cases the hyoid bone, larynx, and trachea all suffered together from a common injury.

*Symptoms.*—The symptoms of fracture of the larynx vary considerably according to the extent of the injury done to the cartilages and the soft parts connected therewith. I have myself met with only one case:

The patient was an acrobat, and whilst lying flat on the floor another gymnast had jumped on his neck; he had often done this before without any bad effect, but on the occasion referred to great pain was felt at the time, and soon afterwards a feeling of constriction was experienced in the throat, and the patient had great difficulty in swallowing. I saw him three days after the accident, in July,

[1] Ibid.

[2] See the experiments made by Keiller ("Edin. Med. Journ." 1856, p. 824); Cavasse: "Gazette Hebdom." 1861, p. 372; Helwig: "Casper's Vierteljahrschrift," 1861, Bd. xix. p. 340; and Gurlt: Loc. cit.

[3] "Annales des maladies de l'oreille," &c. Mars, 1878.

1865. There was a vertical fracture of the thyroid cartilage in the median line. The soft parts over the anterior part of the larynx were not at all swollen though slightly ecchymotic. The two alæ could be easily made to move on each other, and produced distinct crepitation. A laryngoscopic examination showed considerable œdema and redness of the epiglottis. The patient suffered from complete aphonia and great dysphagia. Strips of plaster were applied transversely across the thyroid cartilage, and the epiglottis was scarified. At the end of a few days the patient was able to swallow well, but the hoarseness remained for six weeks; at that time the cartilage had completely united, and there was no trace of a fracture.

The usual symptoms of fracture of the larynx are dyspnœa, cough, expectoration of mucus tinged with blood, and more or less pain and tenderness in the part. Emphysema of the neck is also likely to supervene, and in some cases the air may penetrate into the cellular tissue of the chest and back, or even further. On manipulation, the broken cartilages will crepitate when the fragments are rubbed against each other, whilst occasionally over-riding of the fractured edges gives rise to a perceptible deformity.

*Prognosis.*—Fractures of the larynx are always attended with considerable risk, as the violence which occasions them is generally great, and the injury to the soft tissues profound. To judge from Hénoque's cases, fracture of the cricoid cartilage is an invariably fatal occurrence, but if tracheotomy be promptly performed some of these cases might probably be saved.

*Treatment.*—Unless the symptoms are very slight it will be advisable to perform tracheotomy as soon as possible, otherwise the patient, although progressing favourably, is not unlikely to perish suddenly on making some slight movement.[1] Hüter[2] goes so far as to say that "as soon as fracture of the larynx has been diagnosed tracheotomy should be performed, and that even in cases where the diagnosis is not quite certain, the operation should nevertheless be carried out. In no case," he observes, "should the practitioner wait till a fit of suffocation comes on, as such an attack may supervene so very suddenly." If the cartilages are much crushed it will perhaps be best to lay open the whole length of the larynx, and endeavour to replace the fragments in their proper position. Dr. Panas[3] suggests that in some cases where tracheotomy is necessary the fractured portions of the laryn-

[1] See a case reported by Fredet: "Quelques considerations sur les fractures traumatiques du larynx." Paris, 1865, p. 5.

[2] "Pitha und Billroth's Handbuch." Erlangen, 1871, p. 12.

[3] Op. cit. p. 4.

geal cartilages may be kept in proper apposition, and the patency of the laryngeal canal preserved, by the introduction of a small hollow india-rubber plug into the larynx from the tracheal opening and its subsequent inflation. Leeches should be applied to the neck, if there is much inflammatory tumefaction; and ice, both externally and internally, is sometimes of service. In cases of extreme injury, extirpation of the larynx or resection may have a future.

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*Dislocations of the Larynx.*—Those luxations which occur between the larynx and hyoid bone will be referred to in the next section, and here intra-laryngeal dislocations alone will be briefly described. Examples of this condition have been reported by Sidlo[1] and Stoerk.[2] In Sidlo's case both the arytenoid cartilages were dislocated forwards and downwards, so that their bodies assumed a horizontal position. The dislocation appears to have been the result of the contraction of a syphilitic cicatrix on the posterior surface of the cricoid cartilage. In Stoerk's two cases the left arytenoid cartilage was in each instance dislocated transversely inwards, and there was at the same time considerable tumefaction of the affected cartilage. Both patients were men whose voices had been of a falsetto character from childhood. One case appears to have resulted from cicatricial contraction after diphtheria; in the other the etiology was altogether unknown.

*Eversion of one or both the ventricles* is another rare form of intra-laryngeal dislocation. Of this condition only three illustrations[3] are on record, and in only one of these (that of Dr. Lefferts[4]) was the accident recognized during life. In the latter case both ventricles were prolapsed, and the left one enormously hypertrophied. The accident appears to have happened during sleep, and had occurred twenty years before the patient came under Dr. Lefferts' notice. Since the time of its occurrence the patient had been hoarse, and latterly there had been considerable dyspnœa. Dr. Lefferts cured his patient by performing thyrotomy and extirpating the everted ventricles.

[1] "Ziemssen's Cyclopædia," vol. vii. p. 968.
[2] "Wiener Med. Wochenscrift," No. 50. 1878.
[3] Mackenzie: "Growths, etc." p. 34.
[4] "New York Med. Record," June 3, 1876.

## FRACTURE AND DISLOCATION OF THE HYOID BONE.

*Latin Eq.*—Fracturæ et luxaturæ ossis hyoides.
*French Eq.*—Fractures et luxations de l'os hyoïde.
*German Eq.*—Fracturen und Verrenkungen des Zungenbeins.
*Italian Eq.*—Fratture e lussazioni dell' osso ioide.

*Fracture.*—The hyoid bone is occasionally fractured, and several examples of this injury are on record. The occurrence, however, is very rare, and no practitioner appears to have encountered more than one case. Gibb [1] has treated the subject almost exhaustively in a monograph based on the consideration of thirteen examples collected from various sources. It appears that the cornua are the only parts of the bone likely to be broken, at least in the adult, as in only one of the thirteen cases was the body fractured, the patient being a child aged six years. Of the remaining examples the right cornu was broken in four, and in five the left. In one case both the greater cornua were fractured, whilst in two the precise nature of the injuries was undetermined. Fracture of the hyoid bone is usually caused by forcible manual compression, as in garrotting, hanging, bow-stringing, or by direct violence, as by falls or blows on the neck. The bone may also be fractured by excessive action of the muscles of the part.[2]

As regards symptoms, there is usually considerable pain in the neck, with inability to turn the head. Extreme odynphagia is also commonly present. The voice is generally much affected, and the patient can only speak with pain and effort, whilst occasionally the injury may produce so much narrowing of the glottis as to threaten death by asphyxia. On examining the throat the fragments will usually be found to be widely separated, and true crepitus is seldom met with. Swelling, ecchymosis, and even lacerations of the mucous membrane of the mouth, are present with more or less frequency. The following case fairly illustrates the accident :—

[1] "On Diseases and Injuries of the Hyoid or Tongue Bone." London, 1862. See also "Pitha and Billroth's Archiv." vol. iii. "Fracturen des Kehlkopfs."
[2] See Gibb : Op. cit.

In November, 1864, a patient came to the Hospital for Diseases of the Throat, suffering from great difficulty of breathing, also from dysphagia and great pain in the throat. The man was a bricklayer, and the previous day he had fallen about thirty-five feet from the scaffolding of a house. He had cut the right side of his face and had greatly contused the right shoulder, but he was not aware of any other injury. There was considerable swelling, and some redness between the angle of the jaw and the thyroid cartilage on the right side, and on making a careful examination of the neck the right greater cornu of the hyoid bone was evidently separated from the body of the bone. The patient was unable to protrude his tongue, as it caused so much pain, and no laryngoscopic examination could be made. Six leeches were applied over the seat of the injury, but the fractured bone could not be "set," as any attempt to manipulate it caused very great pain. On the following day the patient was quite unable to swallow, and it became necessary to feed him with an œsophageal tube. This procedure had to be carried out for eleven days, when the patient sufficiently recovered his power of swallowing. At the end of a month from the time of the accident the fracture was completely united, a superabundant amount of callus having been thrown out around the broken ends of the bone.

The treatment of fractures of the hyoid bone is sufficiently obvious on perusal of the foregoing case. Local blood-letting is advisable if there is much swelling, whilst rest and silence must be strictly enjoined. Sedatives may be given to the patient, and feeding must be carried out, if necessary, by an œsophageal tube. If, however, the passage of the tube causes much pain, the patient must be fed by nutritive enemata. Should symptoms of asphyxia supervene, tracheotomy must at once be resorted to, but scarification of the interior of the larynx may suffice if there is only slight œdema. If the local inflammation is great the patient should suck ice continually, and ice or cold lotions should be applied to the neck externally.

*Dislocation.*—This is an occasional occurrence, but as the symptoms are not very obvious, the condition is probably often overlooked. Gibb [1] has collected several cases, some of which came under his own observation. The causes of the luxation appear to be most frequently a relaxation of the muscles and tissues of the part, which allows of an undue amount of motion. The accident may result from a violent strain, but is more apt to occur when tumours of the neck encroach laterally on the hyoid bone. In several of the examples recorded the dislocation seems to have been almost chronic in its character, and liable to continual recurrence throughout the whole of the patient's life.

[1] Op. cit.

I have met with three cases of dislocation of the hyoid bone. Two of these were caused by the pressure of tumours — one cancerous, the other lymphomatous. The third case occurred in a clergyman who had the power of producing the affection whenever he desired,[1] but in whom it also often occurred involuntarily. In none of these cases were the local symptoms caused by the displacement at all serious. There was no dysphagia, and only slight hoarseness which might have been due to other causes.

Several preparations in anatomical museums illustrate displacement of the hyoid bone by tumours of the neck, such as bronchocele,[2] and malignant growths of the tongue,[3] pharynx,[4] and œsophagus.[5] In a case brought before the Pathological Society [6] and reported on by Gibb, a medullary cancer as large as an orange was situated above and to the right of the thyroid cartilage, overlapping its right wing. The body of the hyoid bone was pushed obliquely to the left side of the thyroid cartilage, its right horn being much displaced upwards, whilst its left horn rested on the superior border of the thyroid cartilage.

The dislocation can generally be easily reduced by throwing the head backwards, relaxing the lower jaw and gently rubbing the displaced bone. The parts may be subsequently strengthened by the cold-water douche and stimulating applications. If a generally relaxed condition of the tissues throughout the body prevails, suitable tonic and analeptic measures are called for.

## WOUNDS OF THE LARYNX.

*Latin Eq.*—Vulnera laryngis.
*French Eq.*—Plaies du larynx.
*German Eq.*—Wunden des Kehlkopfs.
*Italian Eq.*—Ferite della laringe.

DEFINITION. — *Incisions, punctures, contused or lacerated wounds of the larynx from without inwards, whether homicidal, suicidal, or accidental.*

[1] Compare the analogous case of Dr. Ripley, recorded by Gibb (op. cit.).
[2] Univ. Col. Hosp. Mus. 550, W. 5.
[3] St. George's Hosp. Mus. Catalogue, L. ii.
[4] Coll. Surg. Mus. 1095 and 1096.
[5] Ibid.
[6] "Trans." vol. xii.

*Etiology.*—Wounds of the larynx are rare in military surgery, only 6 cases occurring amongst 10,000 wounded.[1] In civil practice, however, owing to the frequency with which the part is injured in suicide, the injury is common. Out of 158 cases of cut-throat collected by Durham,[2] in 61 the wound was inflicted on the larynx, and 45 were through the thyro-hyoid membrane. In 58 cases analyzed by Horteloup[3] 36 occurred between the lower margin of the hyoid bone and the upper edge of the first ring of the trachea. According to Malgaigne,[4] young men, when making suicidal assaults on the throat, as a rule wound themselves above the larynx; whereas in old men the injury is generally inflicted below the cricoid cartilage. The reason of this difference is that old men usually find a difficulty in elevating the chin and throwing the head well back. Punctured wounds of the larynx are generally the result of thrusts made with a bayonet,[5] stiletto, or foil, or by some pointed piece of metal or a nail. These punctured wounds are apt to give rise to emphysema of the neck, sometimes causing serious dyspnœa.[6] Gunshot wounds are generally of a somewhat contused character, but a bullet will sometimes pass through the neck leaving only its track in the thyroid cartilage; or on the other hand it may carry away the greater part of the larynx. A solitary instance is on record in which a bullet fractured the thyroid cartilage without destroying the skin.[7] As a rule, the bullet does not remain in the larynx, but if not removed finds its way to the root of the neck. Four preparations illustrating gunshot wounds are to be found in the Army Medical Museum.[8] In the first instance the ball fractured the lower jaw, passed through the thyro-hyoid membrane, and carried away the epiglottis. In the second the anterior and superior part of the thyroid cartilage was carried away by a bullet, which also fractured the humerus. In the third the ball passed into the larynx from the side,

[1] Witte: "Archiv. für Klinische Chirurgie," Bd. xxi. 1ste C. p. 186.
[2] Holmes' "Surgery," vol. ii. p. 441.
[3] "Plaies du Larynx," etc. Paris, 1869. See also a valuable Article in Pitha-Billroth's "Handbuch," vol. iii. by Dr. George Fischer: "Wunden des Kehlkopfs."
[4] Horteloupe: Op. cit. p. 17.
[5] Durham: Op. cit. p. 447.
[6] Beach: "New York Med. Journ." March, 1877.
[7] George Fischer: "Deutsche Chirurgie." 1880, Lief. 34, p. 132.
[8] Nos. 202, 648, 657, 1440.

and wounded the epiglottis. In the fourth and last case the bullet stuck fast in the upper part of the thyroid cartilage.

*Symptoms.*—Incisions into the larynx (except in the case of surgical operations) are almost invariably transverse. Considerable difference of effect is observed, according as the opening is *large* or *small*. In the former case, if the cartilages are divided entirely through, the wound gapes widely through the action of the muscles which elevate and depress the larynx. There is not usually much hæmorrhage, but asphyxia may occur rapidly through some part, such as a piece of the epiglottis or one of the arytenoid cartilages, falling into the glottis and blocking it up. In extensive wounds of the larynx, the voice is usually altogether extinguished. In small wounds or punctures of the larynx the most prominent symptoms are the result of internal hæmorrhage and emphysema of the cellular tissue of the neck, chest, or even of the whole body. A clot sometimes quickly forms in the trachea or bronchi, and causes death by suffocation. In all cases, if the first dangers of the wound are escaped, subsequent inflammation with tumefaction and formation of pus is very likely to place the life of the patient in jeopardy. In illustration I need only refer to the case recorded by Sir C. Bell[1] in which a girl plunged a small penknife into her larynx; some months later exuberant granulations arose which filled up the glottis, and caused death by suffocation. One of the commonest sequelæ is the formation of a dense web across the larynx, whilst more or less enlargement of the cartilages, from chronic inflammation, is seldom absent. Occasionally a fistulous aperture leading into the larynx remains after the surrounding parts have healed up, not only showing no tendency to spontaneous closure, but resisting all measures except those of a rhinoplastic character. In a case sent to me by Dr. Sutton, of Dover, there was an opening as large as a shilling several years after the wound was inflicted.

*Prognosis.*—Out of 88 cases of large wounds 67 patients recovered and 21 died. In 21 instances of small wounds there were 10 recoveries and 11 deaths.[2] Few patients recover without some modification of the vocal function, but the prognosis in respect to this point depends on the

[1] "Surgical Observations," vol. i. p. 45.
[2] Horteloup: Op. cit. p. 86.

relation of the incision or puncture to the vocal cords. It will be remembered that the danger to respiration does not terminate with the healing of the wound or the relief of the first symptoms. Subsequent cicatricial narrowing of the windpipe may require that the air-passage should be opened, even if that operation was not at first required, or if tracheotomy was performed in the first instance it might either prevent the removal of the tracheal canula, or render tracheotomy necessary a second time.

*Treatment.*—The general treatment will be discussed under the head of Cut-Throat, it being only necessary to remark here that, in the case of gunshot wounds, or jagged cuts, however produced, it is very important to see that any loose fragments of epiglottis, arytenoid cartilage, or mucous membrane, are altogether removed; and that in a punctured wound, any resulting emphysema should be relieved by scarification of the skin. The cicatricial narrowing of the windpipe, which so often results, must be treated by the mechanical measures described at page 392.

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## Burns of the Larynx.[1]

Samuel Cooper[2] and Marjolin[3] first called attention to the frequency of dyspnœa in cases of burn, but it remained for Ryland[4] to point out that this condition was frequently due to burning flame or highly heated air. Since then Durham[5] and Cohen[6] have reported cases. In most of the recorded cases the upper portion of the body was the seat of the burn, but in some instances the lower extremities alone suffered. The *symptoms* are generally great pain in the throat, difficulty of swallowing, dyspnœa, aphonia, and the presence of a quantity of black carbonaceous matter in the sputa. The symptoms usually come on a few hours after the accident. On examining these cases great inflammation of the fauces is generally to be seen, and the larynx in one case, reported by Dr. Cohen, was in a

[1] This subject might perhaps have been more conveniently considered in connection with "Scalds of the Larynx" (page 280), but having been hitherto omitted must be briefly referred to here.

[2] "Dict. of Pract. Surg." Art. Burns.

[3] "Dict. de Médecine." Art. Bruture.

[4] "A Treatise on Diseases and Injuries of the Larynx and Trachea," p. 274, 1837.

[5] "Holmes' System of Surgery," vol. ii. p. 466. Second edition.

[6] Cohen: "Inhalation, its Therapeutics and Practice." 1876, p. 294.

state of acute œdema. There is generally great nervous prostration. The *prognosis* is very serious; it depends not only on the extent and depth of the burn, but also the age and vigour of the patient must be taken into consideration.

The local treatment should consist in making the patient suck ice and using insufflations of morphia; but if there is much œdema, scarification should be employed, and if necessary tracheotomy must be performed.

## FOREIGN BODIES IN THE LARYNX.

*Latin Eq.*—Corpora adventitia in larynge.
*French Eq.*—Corps étrangers dans le larynx.
*German Eq.*—Fremde Körper im Kehlkopf.
*Italian Eq.*—Corpi stranieri nella laringe.

Definition.—*Foreign bodies generally introduced into the larynx from without, most frequently through the mouth during mastication or deglutition, and only very rarely entering through a wound in the neck. Occasionally, however, they pass upwards from the trachea or œsophagus.*

*Etiology.*—A complete collection of all the foreign bodies that at one time or another have found their way into the larynx would probably comprise specimens of every known substance.[1] Flesh, bread, fragments of bones of all edible quadrupeds and fish, stones of various species of fruits, nutshells, grains of corn, peas, beans, shells of mollusks, coins, buttons, pebbles, artificial teeth with their fittings, are examples of the foreign matters that most frequently become impacted in the larynx. The first class of substances, *i.e.*, those connected with alimentary matters, usually gain admission during mastication, whilst the person is laughing or talking; less frequently during the act of deglutition. Foreign bodies of metallic composition are occasionally impacted in the larynx of children, who amuse themselves by putting coins, buttons, small toys, &c., in the mouth. In rarer instances teeth, real or artificial, or tooth-plates, become loosened during sleep and drawn into the glottis. It is, indeed, very frequently during sleep that the metallic

[1] See Gross: "Treatise on Foreign Bodies in the Air-passages." Philadelphia, 1854.

bodies mentioned above find admittance into the air-passages in children who have gone to bed with them in their mouths. An accident of this kind occurred to a lad at Wisbeach in the year 1876.[1] The boy went to sleep with a toy-engine in his mouth, and during the night it passed into the windpipe. Dr. Bury, who was called to the case, found it necessary to perform tracheotomy. The cause of the sudden attack of dyspnœa was not known at the time, and some months later Dr. Bury sent the patient up to me at the Hospital for Diseases of the Throat, and I transferred the case to my principal clinical assistant, Dr. Samuel Johnson, now of Baltimore. The little engine was found to be so deeply embedded in the sub-glottic region that it could only be extracted after Dr. Johnson had performed thyrotomy. The patient made a complete recovery, though his voice has remained up to the present time (July, 1879), slightly hoarse. Peas or puff-darts are sometimes sucked in through tubes; and leeches applied inside the mouth will occasionally make their way downwards, though more frequently these animals get into the larynx from drinking dirty water, an accident which has often happened to soldiers on march. Dr. Massei[2] succeeded in removing from the pharyngo-laryngeal sinus a living leech which had found its way into that situation whilst the patient was drinking some impure river water a fortnight previously. Foreign bodies may also become fixed in the larynx, having previously passed upwards through the trachea or œsophagus. A curious case is related by Edwards,[3] of a boy æt. eight in whom a bronchial gland became detached, passed by an ulcerated opening into one of the bronchi, and was thence expelled up the trachea during violent exertion, so as to become impacted in the rima glottidis. The epiglottis itself may be drawn into the larynx and become spasmodically fixed in that situation. Dr. Solis Cohen[4] remarks that this accident "usually occurs during eating," but that he has "known it occur during swallowing of saliva and threaten asphyxia." This author refers to a case reported by Rühle,[5] and adds that "it is not improbable that some cases of otherwise unaccountable sudden death at a meal may be due to this cause."

[1] "Archives of Clin. Surg." Dec. 1876.
[2] "Il Morgagni." Oct. 1874.
[3] "Med.-Chir. Trans." vol. xxxvi.
[4] Op. cit. Second edition, p. 615, et seq.
[5] Op. cit. p. 13.

If an inspiration be taken incautiously during the act of vomiting, as sometimes occurs in fits of drunkenness, some of the matters passing up from the stomach may be drawn into the larynx and cause suffocation. Foreign bodies may also gain access to the cavity of the larynx directly from without, *i.e.*, by penetrating its walls when driven forcibly, as in the case of bullets, flying fragments of metal, stone, &c. Some idea of the frequency with which foreign matters become fixed in different parts of the air-passages, may be gathered from an analysis of 166 cases made by Bourdillat.[1] Of these in 80 instances the foreign body was arrested in the trachea, in 35 in the larynx, in 26 in the right bronchus, and in 15 in the left bronchus. According to Durham,[2] however, the larynx is the most frequent site of impaction of a foreign body. Out of 15 cases collected by that writer, in 7 the larynx arrested the foreign substance, in 5 the trachea, in 2 the right bronchus, and in 1 the left bronchus.

*Symptoms.*—These vary considerably, according to the size of the foreign body and the mode in which it has become impacted. If fixed in the rima glottidis, and large enough to fill that opening, death may be almost instantaneous, unless the convulsive efforts of the patient at respiration succeed in dislodging it. On the other hand small bodies, such as fish bones, may remain in the larynx for an indefinite period without interrupting respiration, merely giving rise to cough and sensations of discomfort in the part.[3] Sometimes even the temporary impaction of a foreign body gives rise to hæmorrhage from the surface of the mucous membrane, and Sommerbrodt[4] has reported a case in which the mere contact of a foreign body in the act of deglutition led to the immediate formation of a small blood cyst on the dorsal surface of the posterior wall of the larynx. The cyst was opened and the patient at once cured. In many cases when the presence of the foreign

[1] "Gazette Méd." 1861, p. 135. See also a further paper by the same author on "Three Hundred Cases of Foreign Bodies in the Air Passages."—"Gazette Méd." 1868.

[2] Holmes's "System of Surgery," vol. ii. p. 477.

[3] The case of the poet Anacreon, who is supposed to have died from a grape-stone having lodged in the larynx (Pliny, l. vii. c. v.) which is opposed to these instances, is probably an example of "poetical justice," and has reference to the previous mode of life said to have been pursued by Anacreon. Retribution, however, did not overtake the rollicking poet until he was 85 years old!

[4] "Berlin. klin. Wochenschrift." 1878, No. 18.

body does not at first directly obstruct respiration, it does so afterwards indirectly by causing inflammation and tumefaction of the soft parts of the larynx. In another class of cases the foreign body may at first allow of freedom of respiration, but subsequently take up an altered position,[1] which immediately menaces life. Thus a substance of irregular shape may pass the glottis and become arrested in the trachea, and after a variable interval be driven upwards during a fit of coughing, so as to become firmly wedged into the rima glottidis. Under these circumstances sudden death may be the result. When the foreign body is impacted in one of the ventricles[2] it cannot generally be moved, and if it passes into both ventricles it will most likely require to be broken or crushed before it can be extracted (see case, page 417). In some instances considerable danger accrues, not from the position of the foreign body, or from inflammation, but from violent spasm of the glottis, brought about by the irritation applied directly to the part. As a rule great anxiety and terror on the part of the patient accompany the entrance of any foreign body, however small, into the air-passages, and in many cases somewhat mask the real importance of the accident. In those cases where the foreign body remains in the larynx without causing immediate danger to life by asphyxia, pain is a prominent symptom. Sharp and angular bodies of any size cause very acute and continuous pain when they become impacted so as to press against the contiguous soft parts, and, of course, quickly give rise to high inflammation. The position taken up by any foreign body in the larynx can usually be seen on using the laryngoscope.

*Diagnosis.*—The presence of a foreign body in the larynx can seldom remain for long a matter of doubt. The history of the case is usually clear, and laryngoscopic examination verifies or disproves the statement made by the patient. In the case of children and hysterical females, however,

[1] See a case in point by Porter, "Dub. Med. Press," Feb. 9, 1859.

[2] See the case of a button-mould fixed in the left ventricle of the larynx, and extracted after six weeks by laryngotomy (Pelletan: "Clin. Chir." t. i. p. 8). Also an instance by Desault, where a cherry-stone remained in one of the laryngeal ventricles for two years, at the end of which time the patient died from disease of the larynx ("Œuvres Chir." t. ii. p. 258). In a case mentioned by Sir Thomas Watson, a piece of gold remained for years in a similar position without detriment to the patient ("Pract. of Physic." Fifth edition, vol. ii. p. 261).

the diagnosis cannot always be arrived at immediately. A child may come home complaining of its throat, and in a short time present symptoms closely resembling croup. The little sufferer has swallowed something used as a plaything, such as a button, small coin, or toy, but either forgets the circumstance or is afraid to tell it. By a careful consideration of all the facts connected with the case, however, and by laryngoscopic examination, the true nature of the affection may generally be brought out. As will be hereafter explained, hysterical persons, suffering from hyperæsthesia or paræsthesia of the larynx, often erroneously fancy that something is sticking in the part. Such cases have generally only to be seen to be recognized.

*Prognosis.*—Death, of course, sometimes follows immediately on the accident. When this is delayed, there is always great danger as long as the foreign body remains in the larynx or air-passages. A fatal result may occur after a time from two different causes, viz.: either the foreign body may become dislodged, and assuming an altered position, may close the glottis and suffocate the patient in a few minutes; or the amount of inflammation and tumefaction of the soft parts of the larynx may more gradually lead to the same result. Even after the foreign body has been removed, a cautious prognosis must be given as long as there are any symptoms of local inflammation.

*Treatment.*—The indication of paramount importance is, of course, to remove the foreign body at the earliest opportunity. Mr. Durham[1] has collected 554 cases of foreign bodies in the air-passages, in 283 of which the substance was extracted by opening the windpipe or otherwise by the medical attendant, whilst in 271 the efforts of nature were left unaided, except in 51 cases where emetics were given. In the first set of cases the deaths amounted to 70 (24·8 per cent.), and in the second set to 115 (42·5 per cent.). Great encouragement is thus given to operative procedures, but it must be taken into consideration in drawing inferences from these tables that death without the expulsion of the foreign body occurred in the cases not operated on 95 times. Doubtless in many of these instances the fatal result was immediate, before surgical aid could be obtained or operative measures adopted. On the other hand, in the cases subjected to operation, the foreign body was probably

[1] Op. cit. p. 488.

fixed in a position which admitted of delay, and of course materially lessened the danger of the accident.

If the symptoms are not urgent, a laryngoscopic examination should be made, and the foreign body, if possible, removed with the aid of forceps. The common laryngeal forceps generally answer best, though in the case of children, on account of the small size of the larynx, the tube-forceps are more convenient. But if the patient be found at the last gasp, the first action of the surgeon should be to open the trachea and introduce a canula. Respiration being thus provided for, the laryngeal mirror may be subsequently used, and the foreign body removed *per vias naturales*. In some cases the foreign body cannot be extracted until it has broken into fragments, as in an instance (hereinafter described) which came under my notice. In some cases, either before or after tracheotomy, according to the urgency of the symptoms, the foreign body may be got rid of by placing the patient head downwards and shaking the body. This procedure, which is more likely to answer in the case of smooth and roundish bodies, such as coins, buttons, and stones, is more particularly applicable in the case of foreign bodies lodged below the larynx, and will be found described in detail under Foreign Bodies in the Trachea. Sometimes after reducing the local inflammation by suitable remedies, a foreign body, previously immovably fixed, can be easily extracted. This fact was illustrated by a remarkably successful case of Dr. Whistler's,[1] in which, with the aid of the laryngoscope, he removed a lamella of bone, measuring nearly an inch by three-fourths of an inch, from below the vocal cords six weeks after it had become firmly embedded in the laryngeal tissues. If this method fails, recourse must be had to thyrotomy, practised in the same manner as for the removal of growths from the larynx[2]; but owing to the risk of producing permanent aphonia, the laryngeal cartilages should, if possible, be left intact. As the operation approaches completion, some caution is necessary, in order to prevent the foreign body slipping down into the trachea after the larynx is laid open. When seen, the object should be grasped firmly with forceps and extracted. Not unfrequently, however, a forcible expiration through the wound expels the foreign body as soon as the windpipe is opened.

Before removing the tracheal canula and closing the

[1] "Lancet." Dec. 2, 1876.

[2] See page 325.

opening, great care should be taken to ascertain that the patient can breathe freely through the larynx. After the injured parts have regained their natural condition, an experiment may be made by corking the canula, which may afterwards be entirely removed as soon as it becomes evident that the patient is able to breathe freely for an indefinite period through the larynx. The following case is a good illustration of the impaction of a foreign body in the larynx:

## CASE OF IMPACTION OF A LAMELLA OF BONE TRANSVERSELY IN THE VENTRICLES.

John B., aged fifty, a labourer, suffering from aphonia, dyspnœa and dysphagia, was brought to me on September 29, 1866, by Mr. John Cumming. The patient stated that three days previously, whilst taking some soup (made from sheep's head) he suddenly felt choked by something "going the wrong way." He tried to get it up with his fingers, but did not succeed. Subsequently, he vomited violently, and after bringing up large quantities of blood, fell insensible on the floor. On examining him with the laryngoscope, a piece of bone was seen to be lodged

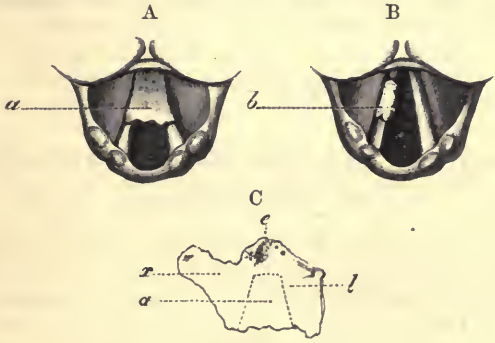


FIG. 87.

A Shows the view of the larynx as first seen: *a* is a horizontal lamella of bone, whose outer extremities pass into the ventricles of each side. B Shows the view of the larynx, after the bone has been broken, and the central portion and that passing into the left ventricle have been removed: *b* is the fractured edge of the fragment of the bone remaining in the right ventricle. C is the bone put together after removal: *a* corresponds to the portion indicated by the same letter in A; *r* is the part which passed into the right ventricle; *l* the portion which rested in the left ventricle, and *e* the surface of the bone that was hidden by the epiglottis.

horizontally in the larynx, just above the level of the vocal cords, in such a manner that it completely blocked up the anterior third of the laryngeal canal (Fig. A). The bone could not be moved with a laryngeal probe, and after repeated unsuccessful efforts to seize it

with forceps, the symptoms being very urgent, tracheotomy was performed. On October 5 Sir William Fergusson attempted, with various instruments, to remove the bone; but it was so impacted that it could not be dislodged. That eminent surgeon recommended that, if after a delay of a few days, the bone was still impacted, the thyroid cartilage should be divided, and the bone removed through the wound. On October 14 I succeeded in passing a blunt hook behind and below the bone, and in this manner brought up a thin lamina of bone about half an inch across in each direction. On the following day a small piece of bone was seen projecting from the right ventricle (Fig. B). After passing an instrument below, and slightly moving the fragment, the patient coughed up a piece of bone, about half an inch long, and a quarter of an inch wide, covered on one side with gristle. On putting the pieces of bone together, they made altogether a lamina three-quarters of an inch long, and half an inch wide (Fig. C.) This had been impacted horizontally with its long diameter across the larynx in such a manner that about three-eighths of an inch had extended into the right ventricle, and rather less than a quarter of an inch of the bone into the left ventricle; in this way the bone could not move to the smallest extent either upwards or downwards. It will be seen therefore that the bone could only be removed by fracturing the portion in one of the ventricles, and that the portion in the right ventricle was separated from the main part by the operation on the 14th. On the 16th the patient was discharged cured. The bone was shown at the Pathological Society, and further details will be found in the *Transactions* (vol. xviii. p. 27, et seq.).

## [NERVO-MUSCULAR AND SENSORY AFFECTIONS OF THE LARYNX.

Before proceeding to describe the various laryngeal neuroses in detail, it is desirable to make a few remarks here on the classification of these important diseases.

Nervous affections of the larynx may be divided primarily into two classes, viz., (1) neuroses of sensation, and (2) neuroses of motion. Concerning the first class, our knowledge is very limited, not only on account of the rarity of the lesion, but also because the subject has hitherto received little attention from laryngoscopists. Disturbances of the motor apparatus of the larynx have, however, been more carefully studied, and the observations of Ziemssen,[1] Gerhardt,[2]

[1] "Cyclopædia of Medicine," vol. vii. p. 993.

[2] Virchow's "Archiv," vol. xxi. Volkmann's "Sammlung Klin. Vorträge," No. 36, 1872. Laryngologische Beiträge, D. "Archiv f. Klin. Med." Bd. xi. p. 575, 1873.

Riegel,[1] and others have provided us with a more complete, though still imperfect, picture of their origin, course and issue.

There are four kinds of disturbance of the *sensory functions* of the laryngeal mucous membrane, viz., (1) anæsthesia, (2) hyperæsthesia, (3) paræsthesia, and (4) neuralgia or hyperalgesia.

Neuroses of motion may be conveniently divided into the two natural classes, viz., (1) loss of power, or paralysis, and (2) perverted power, or spasm.

Under *loss of power* we have:

1. Paralysis from disease or injury of that portion of the medulla oblongata which constitutes the floor of the fourth ventricle;
2. Paralysis from disease or injury of the spinal accessory nerve;
3. Paralysis from disease or injury of the pneumogastric nerve;
4. Paralysis from disease or injury of the superior laryngeal nerve;
5. Paralysis from disease or injury of the recurrent laryngeal nerve; and
6. Paralysis of individual muscles, or sets of muscles—a class of affections which, though generally of myopathic nature, can be most conveniently considered in this subdivision.

Under *perverted power* we have:

1. Spasm of the adductors of the vocal cords and its cognate affections; and
2. Spasm of the tensors of the vocal cords.]

## ANÆSTHESIA OF THE LARYNX.

*Latin Eq.*—Anæsthesia laryngis.
*French Eq.*—Anesthésie du larynx.
*German Eq.*—Anæsthesie des Kehlkopfs.
*Italian Eq.*—Anestesia della laringe.

DEFINITION.—*Loss of sensibility of the mucous membrane of the larynx, due to central or peripheral disease of the nervous system.*

*Etiology.*—This condition, as a serious manifestation,

[1] Ibid: Bd. vi. p. 37, 1869; Bd. vii. p. 204, 1870; and Volkmann's "Samm. Klin. Vorträge," No. 95, 1875.

appears to be confined to cases of diphtheritic and bulbar paralysis. Chairou [1] remarks that anæsthesia of the epiglottis and larynx is an invariable concomitant of hysteria; but, although there is sometimes a slightly diminished sensibility of the *pharynx* in these cases, I have never observed that the mucous membrane of the *larynx* was at all obtuse to direct impressions. Romberg [2] states that in severe cases of cholera there is impaired sensibility of the mucous membrane of the larynx.

*Symptoms.*—In some cases the loss of sensation does not reach below the vocal cords, whilst in others the anæsthesia extends to the greater part of the mucous lining of the trachea.[3] The affection varies also in intensity; sometimes it is so complete that any part of the epiglottis or laryngeal cavity may be touched with a sound without producing any sensation or movement of the larynx; whilst in other cases it is incomplete, a sensation being experienced, but not giving rise to the reflex act of coughing. The anæsthesia may also be confined to one side, or may be bi-lateral. Dysphagia often occurs in these cases, food, especially in the liquid form, having a tendency to pass into the windpipe. This phenomenon was formerly supposed to result because the insensible condition of the mucous membrane of the larynx allowed particles to enter the air-passage, but it would appear that the actual cause of the penetration of food, is the associated paralysis of the muscles depressing the epiglottis. The motor phenomena commonly co-existing with anæthesia will be found described at p. 435.

*Prognosis.*—Except in cases of bulbar paralysis, laryngeal anæsthesia generally terminates in recovery in a period varying from four to six weeks. It must not be forgotten, however, that in extreme cases, if proper means have not been taken to prevent the passage of food into the windpipe, death is likely to result from pneumonia.

*Diagnosis.*—In the absence of any obstruction of the pharynx or œsophagus, the tendency of food to pass into the larynx when the patient is swallowing strongly points to the probable existence of anæsthesia, but certainty can only be attained with the laryngeal probe.

[1] "Études Chir. sur l'Hystérie." Paris, 1870.

[2] Hufeland's "Journal der pract. Heilkunde." Feb. 1832.

[3] See Schnitzler: "Wiener Med. Presse," Nos. 46 and 48, 1873. See also Leube: "D. Arch. f. Klin. Méd." Bd. vi. p. 266, 1869; and Acker, Ibid. Bd. xiii. p. 416, 1874.

*Pathology.*—All cases of true anæsthesia of the larynx must be due to loss of function of the superior laryngeal nerve, or of certain fibres in the pneumogastric nerve which ultimately form the superior laryngeal nerve, or a minute portion of the nucleus of the pneumogastric nerve must be involved in the floor of the fourth ventricle. The change which takes place in the nerve-structures in diphtheria will be found described at page 155, and in greater detail in my recently published work.[1] The pathology of bulbar paralysis is contained in the ordinary text books of medicine.

*Treatment.*—The local application of electricity is the most important remedy in this class of diseases. I formerly only employed faradism, but during the last five years I have, as a rule, used both the galvanic and induced currents. In any case the current should be sufficiently strong to cause discomfort, but not pain. In order to carry out this treatment, either the double laryngeal rheophores (page 253) or my single electrode (page 252) may be used. If the latter instrument is employed the necklet should be worn, so that its metal disc lies over some portion of the course of the superior laryngeal nerve between the greater cornu of the hyoid bone, and the base of the arytenoid cartilage. In either case the instrument may be introduced daily into the larynx, and used six or eight times at a sitting. Whilst the local treatment is being thus pursued, it is also advisable to improve the health of the patient by general tonics, and especially by the administration of strychnine; and if, in swallowing, food enters the larynx, the patient should be fed with the œsophageal tube. In introducing the instrument care should be taken not to pass it into the larynx, an accident which is not unlikely to occur in this class of cases. The tube should therefore be guided down the throat as far as possible by the finger, and when *in situ*, if there be any doubt as to its position, the patient should be desired to produce a vocal sound before any food is injected.

## CASES OF ANÆSTHESIA OF THE LARYNX AFTER DIPHTHERIA.

*Case* 1.—On November 5th, 1876, two sisters, suffering from anæsthesia of the larynx, came under my notice. The first case was that of Mrs. W., aged forty-three, who was recovering from diphtheria when I first saw her. Three of her children had been attacked with the disease, and as they were recovering she became affected. When I saw her the pharynx was slightly

[1] "Diphtheria." 1879, p. 38, et seq.

œdematous and red. There was abundant frothy secretion, but no false membrane, and she was able to swallow with slight difficulty. On November 8th the dysphagia had greatly increased, she became much weaker, and could scarcely stand. In attempting to walk her gait was unsteady, and she once fell down in walking across her room. On November 9th the patient was unable to swallow at all, everything passing into the windpipe, and giving rise to paroxysms of coughing. Her voice was weak and nasal, but distinctly phonetic. The uvula and palate were both completely paralysed and insensible, and on making a laryngoscopic examination the epiglottis was seen to be slightly inflamed, and retracted against the back of the tongue, so that only its under surface was visible. The vocal cords appeared healthy in colour, and their adductive action was normal. On introducing a laryngeal probe into the larynx and touching the epiglottis and vocal cords no effect was produced, but the action of the vocal cords prevented the passage of the sound into the sub-glottic region. On placing the finger on the crico-thyroid muscle, and directing the patient to speak, the muscle was felt to contract normally.

This patient was fed by means of the œsophageal tube twice a day for a fortnight, when to a great extent she had recovered her power of swallowing; both galvanic and induced currents of electricity were also applied daily for a month to the pharynx and larynx. Strychnia was administered in this case, but after taking $\frac{1}{30}$th of a grain three times a day for two days, toxic effects were produced, and the drug was accordingly discontinued, and quinine prescribed. By the middle of December the general health was greatly improved; the patient had quite recovered her power of walking, but she had occasional trouble in deglutition, and was attacked with paroxysms of choking and coughing during meals. On referring to my note book I find that complete insensibility of the larynx remained for ten days after I had first noticed it. After this it gradually disappeared, but the attacks of choking and violent coughing in swallowing continued some weeks after the larynx had recovered its sensibility to the impression of the laryngeal sound and the epiglottis had regained its power. The voice was still nasal, and there was paresis of the palate on January 1st. The patient left town at this period, and I heard that her voice did not become quite normal till the middle of February.

*Case* 2.—Miss A., aged forty-one, who had assisted in nursing the children of her sister (the patient whose case has just been recorded), also suffered from an attack of diphtheria. About ten days after recovery difficulty of swallowing came on—the symptoms being very much the same as those described in the case of Mrs. W.—but the voice was completely lost, and she also had diplopia. Unlike the previous case the power of the lower extremities was perfect. The palate was found to be paralysed, and there was complete insensibility of the larynx on introduction of the laryngeal sound. The adductor of the right vocal cord was also paralysed, and the left cord moved feebly towards the median line. Attempts were made to ascertain whether the crico-thyroid muscle was paralysed, but the non-action of the adductors rendered it impossible to ascertain laryngoscopically the state of tension of the cords, and the examination of the muscle externally only furnished negative results. This patient was also fed with the œsophageal

tube, but did not recover her power of swallowing for more than a month, in spite of the daily use of both forms of electricity, applied directly to the pharynx and larynx, and the administration of strychnia ($\frac{1}{12}$th of a grain) three times a day. The adductors recovered their power and the voice was restored a fortnight before the œsophageal tube could be dispensed with. On the restoration of the voice it was found to have a nasal character, which it continued to possess as long as the patient remained under my observation. The palate also did not completely recover, the words *rub*, *head*, and *egg*, when gently pronounced by the patient, sounding as *rum*, *hen*, and *eng*.

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## Hyperæsthesia, Paræsthesia, and Neuralgia.

Definition.—*Increased or perverted sensibility of the mucous membrane of the larynx, or regularly intermittent pain in that organ unaccompanied by serious structural changes.*

*Etiology.* — Hyperæsthesia is often present when the external parts of the larynx, such as the epiglottis, the ary-epiglottic folds, or the inter-arytenoid fold, are affected by severe inflammation, but this symptom has already been dealt with in describing both acute and chronic laryngitis. Paræsthesia appears in most cases to be the result of some hysterical condition of the system. After a foreign body, temporarily impacted in the larynx, has been extracted, a condition of hyperæsthesia or paræsthesia frequently remains behind for some hours or even days. Preachers and others who are obliged to make much use of their voice are especially liable to suffer from a morbid sensibility of the larynx; in such cases, the local neurosis may be only a symptom of nervous irritability and hypochondriasis, or may be the result of structural changes. True neuralgia of the larynx generally appears to result from cold, or occurs as a sequel to an inflammatory affection. Schnitzler[1] has reported a case of the kind in a man, æt. thirty-six, who had just recovered from an acute attack of angina.

*Symptoms.*—In hyperæsthesia of the mucous membrane of the larynx the parts are abnormally responsive to the least irritation, so that even coughing and deglutition often occasion disagreeable sensations of various kinds, such as burning, pricking, dryness, constriction, or rawness. In some cases the condition gives rise to a troublesome cough, but true "nervous laryngeal cough" (hereinafter described) usually occurs without any altered sensibility of the larynx.

[1] Loc. cit.

According to Schnitzler,[1] spasm of the muscles of the pharynx and larynx usually accompanies morbid sensibility of those parts, and may even give rise to general convulsions, but the latter phenomenon is probably due rather to the general state of the nervous system than to the local affection.

In cases of paræsthesia of the larynx, the patient generally complains that some foreign body—which gives the sensation of a hair, a fish-bone, or a rough fragment of any hard substance—is lodged in the throat.. As already remarked, such a disturbance of sensation almost always exists for a short time after the removal of a foreign body, but it also often occurs as an idiopathic condition in hysterical girls and women. In such cases the patient is confident of the presence of some offending substance, and applies to the surgeon for its removal; on laryngoscopic examination, however, no vestige of any foreign matter can be found. It occasionally happens that paræsthesia of the larynx of this nature is present in connection with a condition of the mucous membrane which, as far as tactile tests are concerned, appears to be a form of anæsthesia.

True neuralgia of the larynx is apparently very rare, but cases have been reported by Handfield Jones,[2] Clinton Wagner,[3] and Schnitzler.[4] I have met with only thirteen cases: nine of the patients were women and four men. In seven of these cases the pain was on the left side, darting up from the larynx towards the ear; in four it was on the right side and extended in the corresponding direction; and in two cases the pain was on both sides. In all these cases the pain was distinctly intermittent, and in three instances was relieved by pressure. Eight of the patients recovered under the use of quinine and persistent pencilling of the laryngeal mucous membrane with chloroform and morphia. Three derived no benefit from treatment, and two discontinued attendance after a short time, the result being unknown. Even the successful cases, however, proved very obstinate. The ages of the women were as follows:—

| | |
|---|---|
| From 15 to 20 years.. .. .. .. | 1 case. |
| „ 20 to 25 „ .. .. .. | 5 cases. |
| „ 25 to 30 „ .. .. .. | 2 „ |
| At 47 years .. .. .. .. .. | 1 case. |

[1] "Wiener Med. Presse," 1873, pp. 1052 and 1107.
[2] "Med. Times and Gaz." May 2, 1863.
[3] "New York Med. Record," Jan. 20, 1875.
[4] Loc. cit.

The ages of the male patients were seventeen, nineteen, twenty-three, and twenty-seven.

*Prognosis.*—A favourable prognosis may generally be given, but it must not be forgotten that disturbances of the sensibility of the laryngeal mucous membrane are often very persistent. Even when consequent on chronic catarrh, the neurosis sometimes continues to trouble the patient long after the catarrhal condition has been removed.

*Treatment.*—When the laryngeal neurosis, although existing as a local affection *per se*, is associated with an hysterical or hypochondriacal condition, our attention must be mainly directed towards improving the general health. In such cases, change of air, sea bathing, or a course of hydropathic treatment, are most likely to effect a cure of both the constitutional and local disorders. When the malady appears to be purely local, the application of strongly astringent solutions is often of great benefit, but I have found morphia and chloroform, as recommended by Schnitzler, still more useful. Dr. Handfield Jones considers that most cases of laryngeal dysæsthesia are of a rheumatic nature, and recommends the administration of iodide of potash. Tobold[1] gives the preference to solution of bromide of potassium. At the same time bromide of potassium should be given internally.

## LARYNGEAL PARALYSIS FROM DISEASE OR INJURY OF THE MEDULLA OBLONGATA.

*Latin Eq.*—Paralysis laryngea ex morbo vel lesione medullæ oblongatæ.

*French Eq.*—Paralysie laryngée résultant de maladie ou de lésion de la moelle allongée.

*German Eq.*—Kehlkopflähmung in Folge von Krankheit oder Verletzung der Medulla oblongata.

*Italian Eq.*—Paralisi laringea da malattia o lesione del midollo allungato.

Definition.—*Paralysis of some of the muscles of the larynx, and usually at the same time of some other muscles of the head, face, or extremities, indicative of central disease of the nervous system.*

[1] "Laryngoscopie u. Kehlkopfkrankheiten." 1874, p. 343.

*Etiology.*—In order to do justice to the etiology of this disease it would be necessary to arrive at the causes of locomotor ataxy,[1] multiple sclerosis, and progressive bulbar paralysis. These affections will be found fully described in the various text books, and it is only necessary to remark here, that heredity, depressing emotions, excessive mental excitement, and exposure to cold are generally regarded as their chief predisponents. In a considerable proportion of the cases that have come under my notice it will be seen that the patient had suffered from syphilis, and in one instance a gumma was found in the brain.

*Symptoms.*—In laryngeal affections due to disease of the brain there are generally other symptoms indicative of cerebral disorder. Thus we frequently meet with paralysis of one of the limbs, or loss of power of particular muscles, or one of the special senses may be destroyed. The general symptoms vary according to the particular nucleus which is involved. Sometimes convulsions are present. The laryngeal symptoms also vary greatly ; in some cases the nucleus of one recurrent nerve is completely destroyed, and we have loss of power of all the muscles acting on one vocal cord, whilst in others the nuclei of the adductor or abductor filaments may be alone involved; hence, sometimes there is merely hoarseness or loss of voice, whilst in others there is great stridor in breathing.[2]

*Pathology.*—Neuroses of the larynx dependent on central lesions have their origin in organic disease of the roots of the pneumogastric and spinal accessory nerves in the floor of the fourth ventricle. These paralyses occur, therefore, in connection with brain affections involving the medulla oblongata and pons Varolii, and are occasionally met with in the diseases already referred to under "Etiology." In the only case that has come under my own notice in which a post-mortem examination was made the disease was of a syphilitic nature ; the surface of the medulla oblongata was soft and creamy, but on section the structure appeared healthy. Unfortunately no microscopic examination was made. In Pentzoldt's

[1] A case in which locomotor ataxy was present has been reported by Professor Charcot ("Gazette des Hôpitaux," No. 1, 1879), as an example of "laryngeal crisis," but the use of this term does not appear to possess any particular advantage.

[2] In addition to my own cases, I would refer the reader to the excellent illustrations of the affection published by Pentzoldt ("D. Archiv f. Klin. Med." Bd. xiii. 1874), and Beverley Robinson ("Amer. Journ. of Med. Sci." April, 1878).

case the olivary bodies were ill-defined, whilst the anterior pyramids were grey and had a "gelatinous gloss."

*Diagnosis.*—The most marked characteristic of central paralysis of the laryngeal muscles is the co-existent implication of other nerves—generally of those supplying the palate and tongue, though the facial nerve is sometimes involved.

*Prognosis.*—The prognosis is generally very unfavourable, but in syphilitic cases the disease may be arrested.

*Treatment.*—The affection can only be treated symptomatically. If syphilis is present, iodide of potassium should be administered; whilst if the abductors are paralysed tracheotomy may be necessary.

## CASES ILLUSTRATIVE OF PARALYSES FROM DISEASE OF THE MEDULLA OBLONGATA.

*Case* 1. *Complete Paralysis of the Left Vocal Cord.*—Thomas C., aged fifty, was under the care of Dr. Hughlings Jackson, in the London Hospital, in March, 1864, and I was requested by my colleague to make an examination of the larynx. Dr. Jackson showed me that the patient had paralysis with wasting of the right side of the tongue, the right side of the palate, the right trapezius, and loss of power of the right side of the orbicularis oris. With the laryngoscope, the right vocal cord was seen to maintain the cadaveric position. It is evident that disease of the medulla oblongata alone, and that near the nuclei of the spinal accessory and hypoglossal nerves, could produce these various paralyses. This patient was seen in 1866 and the disease had not then advanced. (Lond. Hosp. Reports, vol. 1. p. 361.)

*Case* 2. *Complete Paralysis of the Left Vocal Cord.*—In 1865, Z. S., a man aged forty-three, came under my care at the London Hospital, with loss of sensation on the left side of the face, diminished power of taste on the left side of the tongue, paralysis of the left half of the palate, and a shrill voice. About two inches behind the ear and on a level a little below the meatus, was a ragged-edged scar, over a brawny mass running downwards, but slanting forwards as far as the inferior angle of the lower jaw. The sterno-mastoid appeared to run into the mass in front; and behind the scar and below the general mass the belly of the muscle was hard and prominent. The anterior edge of the trapezius also was hardened and cord-like. With the laryngoscope, the left vocal cord was seen to be immoveably fixed in the cadaveric position. There was iritis of the left eye, and besides some opacity of the lower part of the cornea. I transferred the patient to Dr. Hughlings Jackson; and under iodide of potassium and good diet he improved wonderfully. It is true that the paralyses did not pass away, but the general health was apparently restored, and the swelling in the neck reduced and softened.

A few months later, however, the man died from hemiplegia. The membranes at the base of the brain, especially in the course of the fissures, were found to be thickened by a dirty glue-like material. The walls of the left vertebral artery were much

increased in bulk, and the right middle cerebral artery entered a tumour about the size of a nut, which on section was soft, and yellowish white—evidently a gumma. A similar tumour was found extending from a branch of the left middle cerebral artery. The surface of the medulla oblongata was soft and creamy, but on section the structure, which was not subjected to microscopical examination, appeared healthy. On examination of the larynx after death by my cousin, Mr. Frederick M. Mackenzie, the left crico-arytenoideus-posticus was thin, pale in colour, and transparent, whilst the right muscle was of a deep red colour and twice the thickness of its fellow. The other muscles of the larynx do not appear to have been examined.

For further particulars see "Lond. Hosp. Reports," vol. iv. 1867, page 314, et seq.

*Case* 3. *Complete Paralysis of the Right Vocal Cord*—In December, 1868, I was requested by my colleague, Dr. Hughlings Jackson, to see J. G., aged fifty, who was under his care in the London Hospital, suffering from paralysis of several nerves, and from excruciating pains in the head, which scarcely permitted him to get any sleep. The patient's voice was not completely lost, but it was very weak and shrill, and the breathing was slightly stridulous. On laryngoscopic examination, the right vocal cord was seen to be permanently fixed in the cadaveric position. There was slight tumefaction of the right ventricular band, and the side of the epiglottis was a little swollen and pushed towards the left side. "The other defects were," as Dr. Hughlings Jackson described, "all on the right side. The right half of the tongue was greatly wasted, the right half of the palate hung forward a little, and was drawn up to the left, when the patient cried, Oh! and there was nearly complete deafness in the right ear." J. G. had a constant sensation of pain and stiffness at the back of the nose, though nothing could be seen with the rhinoscope. Several times he suffered from severe epistaxis—to the extent of a pint or more on one or two occasions—the blood coming down the nose into the mouth. Externally there was an exceedingly hard tumour, rather longer and narrower than a hen's egg, extending downwards behind the angle of the lower jaw, on the right side of the neck, and on the opposite side there was a similar but much smaller tumour. These tumours were first noticed about a year, and the hoarseness about three months, before I saw the patient. Fourteen years previously the patient had undoubtedly suffered from syphilis. Dr. Hughlings Jackson thought the tumours syphilitic. Although the tumours on the right side might possibly have caused pressure on the pneumogastric nerve, the fact that the right half of the tongue was affected, clearly points to the central origin of the disease, and there can be little doubt but that Dr. Jackson's opinion, "that there was disease of the medulla, near the origin of the spinal accessory, and of several other cranial nerves of the right side," was a correct one.

*Case* 4. **Bilateral Paralysis of the Abductors.**—J. W., aged forty-four, a drover, was admitted into the Hospital for Diseases of the Throat on March 19, 1868, on account of slight difficulty of breathing; his voice was normal. His history was as follows:—Sixteen months ago he was seized with a general paralysis affecting both extremities on both sides of the body. From this he gradually recovered and had now only weakness in his

left arm. On examination the heart and lungs were found to be healthy, but the laryngoscope showed paralysis of the abductors of the vocal cords, which, on inspection, remained only rather more than one-eighth of an inch apart. On phonation they were seen to be properly adducted. This patient only remained under observation for three months, during which time there was neither advance nor improvement in the symptoms.

*Case* 5. **Bilateral Paralysis of the Abductors.**—William G. F., of West Cowes, Isle of Wight, applied at the Hospital for Diseases of the Throat, July 25, 1868, on account of great difficulty of breathing. He states that he was quite well until three years ago, when he took a severe cold, and has never since been well. In December, 1867, he had an epileptic fit, and subsequently had other attacks. After the last fit, he remained unconscious for some hours. He occasionally passes his motions involuntarily, and his urine frequently oozes away. He states that the difficulty of breathing has been gradually getting worse, and that he now makes so much noise during sleep that passers-by stop under his window, and neighbours in the opposite house are disturbed in their rest.

*Present condition.*—The voice is a little husky, but there is no cough. Loud stridor in breathing, greatly increased on the slightest exertion. The larynx is perfectly healthy, with the exception, that on inspiration the vocal cords scarcely move from the median line. No evidence of thoracic disease.

This patient returned to Cowes, where, I am informed by Dr. Hoffmeister, he shortly afterwards died.

*Case* 6. **Bilateral Paralysis of the Abductors.**—James J., aged twenty-five, was admitted into the London Hospital on April 18, 1873. For two years past the patient had been subject to seizures, during which, he says, the power of speech, sight, and motion left him; these were accompanied by nausea and vomiting and by pains in the legs. The patient attributes all the above symptoms to a severe cough, and to violent exertion while playing on the trombone. Fifteen months before he came under notice a peculiarity in his gait was observed, there being an evident loss of co-ordinative muscular power, as in progressive locomotor ataxy. Shortly after this he lost the sight of one eye, and the other eye also became affected a few days later. Fifteen years ago the patient had a primary venereal sore, which was followed by an eruption. *On examination* it was found that both pupils were dilated, and the disks atrophied. Rapid movements of the eyes produced vertigo. The senses of smell and hearing were unimpaired. There was a marked stridor during respiration, and a croupy, inspiratory noise at night. The laryngoscope revealed a partial paralysis of the *crico-arytenoidei postici* muscles, which explained the stridor. There was also a sluggishness in the movements of the muscles of the palate. The administration of iodide of potassium was followed by a speedy improvement in all the symptoms.

*Case* 7. **Bilateral Paralysis of the Abductors.**—On September 25, 1878, I was called to see Mr. G. J. C., who was suffering from difficulty of breathing. On inquiry, I found that the dyspnœa had been coming on for several years, and that for eight or nine years he had had some weakness, amounting to imperfect paralysis, of the right leg. Whilst sitting in bed there was little stridor, but at my request, he got up, and with some difficulty hobbled

across the room with the aid of a stick, when his breathing became decidedly stridulous. He told me that he sometimes made so much noise in his sleep that it awoke him. On examination, the heart and organs of circulation were found to be healthy, but the laryngoscope showed that the vocal cords remained permanently fixed near the median line, being separated, on inspiration, only to the extent of about an eighth of an inch at the posterior portion of the glottis. Mr. C. informed me that he had been seen by Dr. Hughlings Jackson, who had told him that "he had paralysis of some of the muscles of the throat." I recommended tracheotomy, but the patient desired to postpone the operation. On October 10 he went to stay with a friend near Maidstone, and at night retired to bed in his usual condition. In the morning he was found dead. No post-mortem examination was permitted.

## LARYNGEAL PARALYSIS FROM DISEASE OR INJURY OF THE SPINAL ACCESSORY NERVE.

*Latin Eq.*—Paralysis laryngea ex morbo vel lesione nervi accessorii spinalis.

*French Eq.*—Paralysie laryngée résultant de maladie ou de lésion du nerf spinal.

*German Eq.*—Kehlkopflähmung in Folge von Erkrankung oder Verletzung des accessorius Willisii.

*Italian Eq.*—Paralisi laringea da malattia o lesione del nervo spinale.

The previous division includes paralysis due to injury of the nucleus of the spinal accessory, and under the present head we have to consider paralysis due to disease of either of the spinal accessory nerves in their course.[1] The injury to the nerve generally results from the pressure of a malignant tumour leading to disorganization of the brain. No uncomplicated case has come under my notice in which injury of the accessory branch has been proved to exist, but Türck[2] mentions a case of bilateral compression of this nerve in its passage through the foramen lacerum owing to cancerous infiltration of the base of the skull. In this case, which occurred in pre-laryngoscopic times (1855), there was hoarseness up to the time of death. Seeligmüller[3] has recorded an excellent example of this rare affection.

[1] All the cases that have occurred having been complicated by co-existent lesions of other nerves, it is impossible to treat this affection in the systematic manner which has been carried out with the other neuroses.

[2] "Klinik der Kehlkopfkrankheiten," p. 437.

[3] "Archiv für Psychiat. u. Nervenkrank." 1872, vol. iii.

Schech[1] has also reported a most interesting case in which the accessory nerve, in conjunction with the glosso-pharyngeal, pneumogastric, and hypo-glossal nerves, was involved in a sarcomatous tumour at the base of the brain. The symptoms of uncomplicated disease of the accessory nerve are not at present known; whilst treatment can only be expectant, and such as is calculated to promote the euthanasia.

The following case illustrates the affection:

*Paralysis of the Accessory and Spinal Branches of the Spinal Accessory Nerve and of other Nerves.*—Elizabeth S., aged fifty-one, admitted into the London Hospital, November, 1863, on account of difficulty of swallowing, shortness of breath, and loss of voice. In addition to the symptoms already described, the patient suffered from complete deafness of the right ear and slight deafness on the left side. She had some difficulty in putting out the tongue, and its right side was slightly wasted. The uvula and the walls of the pharynx were quite insensible to irritation. On making a laryngoscopic examination both the vocal cords were seen to remain constantly in the cadaveric position. The sensibility of the larynx was not impaired. There was entire loss of smell—the patient could not distinguish between valerian and peppermint, but when strong ammonia was placed to the nostrils she was able to sneeze. She could not shrug her shoulders. After a few weeks a malignant tumour became apparent in the vault of the pharynx, and the conclusion was arrived at that the growth had involved the origin of the glosso-pharyngeal, spinal accessory, and hypo-glossal nerves.

The tumour in the upper part of the pharynx soon after reached the back of the mouth, and became extensively ulcerated and constantly covered with a fœtid discharge. The patient, who after a short time was unable to swallow except with the greatest difficulty, became greatly emaciated, and two days before her death had slight convulsions. She ultimately sank in a comatose condition in January, 1862. Unfortunately a post-mortem examination was not permitted, but there can be no doubt that the case was very similar to that which has recently been reported with such admirable detail by Schech.

## LARYNGEAL PARALYSIS FROM DISEASE OR INJURY OF THE PNEUMOGASTRIC NERVE.

*Latin Eq.*—Paralysis laryngea ex morbo vel lesione nervi pneumogastrici.

*French Eq.*—Paralysie laryngée résultant de maladie ou de lésion du nerf pneumogastrique.

*German Eq.*—Kehlkopflähmung in Folge von Erkrankung oder Verletzung des N. vagus.

*Italian Eq.*—Paralisi laringea da malattia o lesione del nervo pneumogastrici.

[1] "Deutsches Archiv für Klin. Medicin," vol. xxiii. Hft. 1 and 2.

DEFINITION.—*Paralysis of one or both the vocal cords according as the lesion is unilateral or bilateral. In the former case there is dysphonia, in the latter aphonia.*

*Etiology.*—Outside the cranium, as Ziemssen[1] observes, the first point that might be injured is the ganglion of the trunk of the pneumogastric. A complete paralysis of both laryngeal nerves would result from such a lesion, but no example of this condition has as yet been placed on record. Schech[2] has, however, reported a case of post-diphtheritic paralysis, in which some fibres of both pneumogastric nerves, together with its recurrent branches, had undergone fatty degeneration. Below the origin of the pharyngeal and superior laryngeal nerves, the pneumogastric may suffer injury in various ways. I have met with a case in which an aneurism of the carotid compressed the nerve in this situation. The same result may occur in consequence of the presence of bronchocele, or tumours of any kind in the mediastinum. Heller[3] mentions a case in which the trunk of the pneumogastric was the seat of carcinoma; and Cock[4] appears to have injured the nerve in performing pharyngotomy for the removal of a foreign body. Kappeler[5] gives an instance where the nerve was included in a ligature applied to the carotid artery, and also cites the case in which Billroth excised a piece an inch and a half long from the right vagus.

The *symptoms* of a unilateral lesion of the trunk of the pneumogastric are very similar, so far as the larynx is concerned, to those of injury of the recurrent laryngeal nerves, the sensibility of the larynx being either little disturbed or quickly restored. In Cock's case,[6] the voice, which was previously clear, was altered after the operation to the condition of a "husky whisper." Two years later the patient's singing voice had changed from a "fine tenor into a respectable bass." As the result of experiments by vivisection, it would appear that when a pneumogastric nerve is injured, the opposite nerve, as a rule, suffices to discharge the more important functions previously supplied by both nerves. Hence, although in the first instance, the

[1] Loc. cit. p. 944.
[2] Loc. cit.
[3] "D. Archiv f. Klin. Med." vii. p. 204.
[4] "Guy's Hosp. Rep." vol. iv. 3rd series, p. 226.
[5] "Archiv der Heilkunde," 1864, v. s. 271.
[6] Loc. cit.

action of the heart and lungs is temporarily disturbed, these organs generally soon recover. The sensibility of the larynx is also restored after a time, apparently through the nerve influence of the opposite side, and the motor functions of the nerve on the affected side alone permanently suffer.

The *prognosis* is unfavourable as far as regards restoration of function; and *treatment* is generally useless.

*Paralysis of the Right Vocal Cord from Wound of the Pneumogastric Nerve; other Nerves also affected.*—William C., aged thirty, a coachman, was admitted at the Throat Hospital on October 4th, 1870, giving the following history:—On his way home late on the night of August 14th he had been suddenly stabbed from behind; the instrument used was a double-edged knife, the blade of which was about four inches in length. One wound had been received in the left side over the sixth rib, and four other wounds had been inflicted in the back of the neck. Profuse hæmorrhage followed, and the patient became very weak. The next day there was great difficulty of swallowing, and an inability to properly masticate the food. The patient also felt great heat on the right side of the face, and both eyes were constantly suffused with tears. After fourteen days he went into the country; swallowing became more difficult and his state of health more impaired. About six weeks after the occurrence a swelling took place in the front of the throat. On application, the patient was seen to be a strongly-built man, but in a pale anæmic condition. Four nearly-healed wounds were found in the following situations: One just below the prominence of the occiput; a second over the right side of the second cervical vertebra; a third just below, and a quarter of an inch behind the mastoid process. This wound was stated in evidence in the police-court to have been one inch and three-quarters deep. A fourth wound was situated about midway between the second and third. On further examination there was seen to be paralysis of the right side of the tongue, and slight paralysis of the muscles of the upper jaw on the right side. There was diminished sensibility of the right side of the larynx, and loss of power of the abductors and adductors of that side; and there was considerable enlargement of the thyroid body. The patient, who was given mild tonics and generous diet without any special treatment, gradually recovered.

In this case the loss of sensibility of the mucous membrane, the impaired action of the muscles on the right side of the larynx, and the dysphagia, all pointed to an injury of some fibres of the pneumogastric. The paralysis of the right side of the tongue clearly showed injury of the hypoglossal nerve. It was difficult to account for the apparent paralysis of the temporal and masseter muscles, unless it were that this condition had been caused by some tumefaction and stiffness of the articulation of the jaw.

For further particulars see "Brit. Med. Journ.," Dec. 24, 1870.

*Injury of the Pneumogastric Nerve from pressure of an enlarged gland.*—Mrs. C. S., aged thirty-eight, from Taunton, consulted me on May 5th, 1874, on account of hoarseness and slight shortness of breath of six years' duration. On making a laryngoscopic examination, the right vocal cord was seen to be immovably fixed in the cadaveric position, but the sensibility of the larynx was not impaired. An enlarged gland,

about the size of a pigeon's egg, could be felt deeply situated at the side of the right ala of the thyroid cartilage. Mrs. C. S. stated that she had noticed this swelling shortly before the hoarseness first came on. On deep pressure no other enlarged gland could be detected, nor was there any evidence of any other cause producing pressure on the pneumogastric nerve or its branches. It must, therefore, be inferred that the enlarged gland already described pressed on the pneumogastric nerve in such a way that the fibres of the nerve which ultimately formed the recurrent branch were involved.

*Destruction of the Pneumogastric Nerve from suppuration of an enlarged gland.*—Miss L., aged nine years, was brought to me in June, 1875, on account of loss of voice. She was a delicate-looking child, and had a scar on the right side of the neck, about one inch below the angle of the jaw, and about half an inch in length. On examination of the larynx, the right vocal cord was seen to be immovably fixed in the cadaveric position. No loss of sensibility. The history of the case was as follows:—Two years previously the little girl had suffered from glandular swelling in the neck, which had softened and been opened by a surgeon. Soon after the discharge had taken place it was noticed that the child lost her voice, and the parents attributed this symptom to the surgeon's knife. I explained to the little patient's friends that the matter must have burrowed deeply into the neck and thus reached the pneumogastric nerve, or, at least, certain of its fibres, and that the knife used for the purpose in view could not have inflicted the injury.

## LARYNGEAL PARALYSIS FROM DISEASE OR INJURY OF THE SUPERIOR LARYNGEAL NERVE.

*Latin Eq.*—Paralysis laryngea ex morbo vel lesione nervi superioris laryngei.

*French Eq.*—Paralysie laryngée résultant de maladie ou de lésion du nerf laryngé supérieur.

*German Eq.*—Kehlkopflähmung in Folge von Krankheit oder Verletzung des N. laryngeus superior.

*Italian Eq.*—Paralisi laringea da malattia o lesione del nervo laringeo superiore.

DEFINITION.—*Paralysis of the superior laryngeal nerve, giving rise, when complete and bilateral, to anæsthesia of the larynx and loss of power of the crico-thyroid, thyro-epiglottic, and ary-epiglottic muscles.*

*Etiology.*—The only cases in which the existence of this lesion has been hitherto distinguished with any accuracy, have been examples of diphtheria. I have, however, met with one case, which is related at the end of this section, where the affection was due to enlarged glands and inflammation of the areolar tissue beneath the angle of the jaw.

*Symptoms.*—The phenomena due to anæsthesia of the larynx have been already enumerated (p. 420), and it therefore only remains for us to consider here the symptoms dependent on paralysis of the thyro-epiglottic and aryteno-epiglottic muscles (the depressors of the epiglottis), and of the crico-thyroid muscle. When the two former muscles are paralysed, the closure of the larynx during deglutition does not take place, the epiglottis remaining erect against the root of the tongue. There is, in consequence, a continued passage of a portion of the matters swallowed, principally fluids, into the laryngeal inlet, and since, owing to the accompanying anæsthesia, the reflex act of coughing does not occur until the foreign substance passes below the level of the vocal cords, some of the food finds its way down the trachea, and an attack of pneumonia is thus likely to be provoked. Complete paralysis of the crico-thyroid muscles is rare, but when present it is easily distinguished. For on directing the patient to produce a vocal sound, and at the same time placing the finger on the outer portion of the crico-thyroid space, the absence of tension on the part of the crico-thyroid muscle can sometimes be perceived.

FIG. 88.—BILATERAL PARALYSIS OF EXTERNAL TENSORS.

When the affection is bilateral and well marked, the glottis is represented by a wavy line (Fig. 88); there is also not unfrequently a slight depression of the central portion of the vocal cords in inspiration, and a corresponding elevation in expiration and vocalization, and the vocal processes can seldom be seen; when the muscle on one side alone is affected, the corresponding vocal cord remains on a higher level than its fellow.[1]

*Pathology.*—Schech's[2] careful experiments have confirmed the views commonly entertained that the superior laryngeal nerve supplies sensation to the larynx above the level of the

[1] Riegel: "Volkmann's Samml. Klin. Vorträge," No. 95, 1875.

[2] "Zeitschrift f. Biologie," ix. 1873; and Luschka: "Der Kehlkopf des Menschen," p. 166. Tübingen, 1871.

vocal cords, and motor power to the crico-thyroid muscle, and he has further confirmed the view that the thyro-epiglottic and ary-epiglottic muscles receive their motor supply from the same source. The case of Kappeler[1] (already reported, page 432), in which, after accidental removal of a portion of the right pneumogastric nerve (which, of course, includes the nerve-fibrils ultimately forming the superior laryngeal nerve), the muscles of the epiglottis acted normally, and the sensibility of the larynx remained intact, though there was complete paralysis of the right vocal cord, is probably to be explained by the compensatory action of the left nerve. There is, however, much difficulty in meeting the cases of Türck.[2] That excellent observer has reported several cases of pure paralysis of the recurrent nerve in which there was *atrophy and fatty degeneration of the crico-thyroid muscle*, as well as of the laryngeal muscles supplied by the recurrent, whilst the superior laryngeal nerve appeared quite normal under the microscope.

*Prognosis.*—In complete paralysis of both superior laryngeal nerves the patient's condition is attended with considerable danger, but if only one nerve is affected there seems to be little risk. In the former case the patient may either perish from inanition through refusing to take food, or from pneumonia if he continues to swallow aliment in the natural manner. Cases have been reported by Weber,[3] Maingault,[4] Monckton,[5] Ziemssen,[6] and others, in which a fatal termination of paralysis of the throat could only be accounted for by lobular pneumonia, brought about no doubt by the passage of food down the air-tracts.

*Diagnosis.*—The recognition of this form of laryngeal neurosis can only be accomplished with the laryngeal mirror and probe, and has already been referred to in dealing with anæsthesia of the larynx (page 420), as far as regards the anæsthesia of the mucous membrane and the paralysis of the depressors of the epiglottis.

*Treatment.*—The management of cases of paralysis of the depressors of the epiglottis with loss of sensation in the mucous membrane, consists mainly in keeping the patient

[1] "Archiv der Heilkunde," 1864, v. s. 271.
[2] "Klinik der Kehlkopfkrankheiten." Wien, 1866, p. 436.
[3] Virchow's "Archiv." Bd. xxv. p. 114, and Bd. xxviii. p. 489.
[4] "De la Paralysie Diphthéritique." Paris, 1860.
[5] "Second Rep. of Med. Off. of Privy Council," 1860.
[6] Ziemssen and Steffen: "Die Krankheiten des Kehlkopfes." reprint from the 2nd German Edition of Ziemssen's "Cyclopædia."

clear of the disastrous consequences which ensue from the passage of food into the air passages, until the parts affected recover their normal condition. To achieve this object food must be given by means of an œsophageal tube passed beyond the orifice of the larynx. Through this tube any nutritive fluid may be injected, such as milk, beef-tea, chicken-broth, &c. At the same time an attempt must be made to restore the functions of the paralysed muscles by the use of galvanism and faradism, and by the administration of general tonics. On several occasions I have used strychnia with apparent advantage, and Ziemssen counsels the hypodermic injection of this remedy.

## CASE OF INFLAMED CERVICAL GLANDS PRESSING ON THE SUPERIOR LARYNGEAL NERVES.

In May, 1874, H. B., aged thirty-seven, came under my care, at the Hospital for Diseases of the Throat, suffering from inflammation of the *glandulæ concatenatæ* and the adjacent areolar tissue on both sides of the neck. The glands were swollen and inflamed from the back of the neck to the sternum, and at the angle of the jaw the skin was red, hot, and almost erysipelatous in appearance. The patient complained of difficulty of swallowing, liquids constantly "going the wrong way," and he had complete loss of voice. I expected to find considerable inflammation of the internal parts of the throat; but, on laryngoscopic examination, with the exception of some fulness behind the left tonsil, slight congestion of the vocal cords, and an unusually turgid condition of the veins of the pharynx, nothing abnormal was seen. The difficulty of swallowing was considered functional. When, however, the patient paid his next visit, the dysphagia having become worse, a more minute examination of the larynx was made, and it was found that there was complete anæsthesia of its lining membrane. A sound could be applied to any part of the interior of the larynx without producing the slightest cough or irritation. It was also observed that the epiglottis constantly maintained its erect posture, and that the vocal cords, though easily adducted, were not tense. There was no appreciable loss of power of the crico-thyroid muscle, as far as external examination showed. The nerve symptoms were now attributed to pressure on the superior laryngeal nerve. Poultices were applied to the neck, and the patient was directed to swallow nutritive liquids thickened with corn flour. A few days later a post-pharyngeal abscess was opened on the left side, whilst the swelling on the right side of the neck gradually subsided without suppuration. The patient recovered his power of swallowing on the evening of the day the abscess was opened, and his voice returned a few days later. In this case there is little doubt but that the superior laryngeal nerve was pressed on near its division into the external and internal branches.

(For further illustrations, see the diphtheritic cases reported at pages 421 and 422).

## LARYNGEAL PARALYSIS FROM DISEASE OR INJURY OF THE RECURRENT NERVE.

*Latin Eq.*—Paralysis laryngea ex morbo vel lesione nervi recurrentis.

*French Eq.*—Paralysie laryngée résultant de maladie ou de lésion du nerf laryngé inférieur.

*German Eq.*—Kehlkopflähmungen in Folge von Erkrankung oder Verletzung des N. recurrens.

*Italian Eq.*—Paralisi laringea da malattia o lesione del nervo recorrente.

The disease may be either bilateral or unilateral, and we must consider these two conditions separately.

### BILATERAL PARALYSIS.

DEFINITION.—*Paralysis of the recurrent laryngeal nerves, causing complete immobility of both vocal cords and loss of voice. When the paralysis is partial, certain fibrils of the nerve alone being implicated, the abductor muscles are generally first affected, and are sometimes the only muscles which suffer.*

*Etiology.*—Cases of bilateral paralysis of the recurrent laryngeal nerves are comparatively rare, though examples have been reported by Ziemssen,[1] Türck,[2] Traube,[3] and others. The paralysis may be due to disease of the medulla, or to compression or destruction of certain fibres of the pneumogastric nerve, or to direct pressure on the recurrent nerves themselves; that is to say, the lesion may be either central or peripheral. The first two conditions have already been considered in previous sections. There remain, therefore, only the local influences.

I have seen one case in which incomplete paralysis was caused by a double aneurism, and have met with several instances where either complete or partial paralysis was brought about by cancer of the œsophagus, and cancer of the thyroid gland; I have likewise seen several cases where the bilateral pressure was caused by a simple fibrous goitre. Goitre is, perhaps, the most frequent cause of this rare condition; it was, probably, the condition in Gerhardt's case,[4] though, as the abductors alone were affected, that case

[1] Loc. cit. p. 950. [2] Op. cit. p. 428.
[3] "Deutsche Klinik." 1860, No. 41, and 1861, No. 27.
[4] "Virchow's Archiv." 1863, vol. xxiii. pp. 68 and 269.

was reported as an example of paralysis of those muscles. The annexed cut (Fig. 89) shows how readily slight enlargement of the tissues in the neighbourhood of the œsophagus and thyroid gland may involve both the recurrent nerves. Enlargement, also, of the bronchial glands, or the development of an abundant and dense connective-tissue in their neighbourhood, occasionally gives rise to pressure on the nerves (*see* my case hereinafter related, and also Riegel's case,[1] in which the abductor filaments alone suffered). Koch's[2] case is also of a

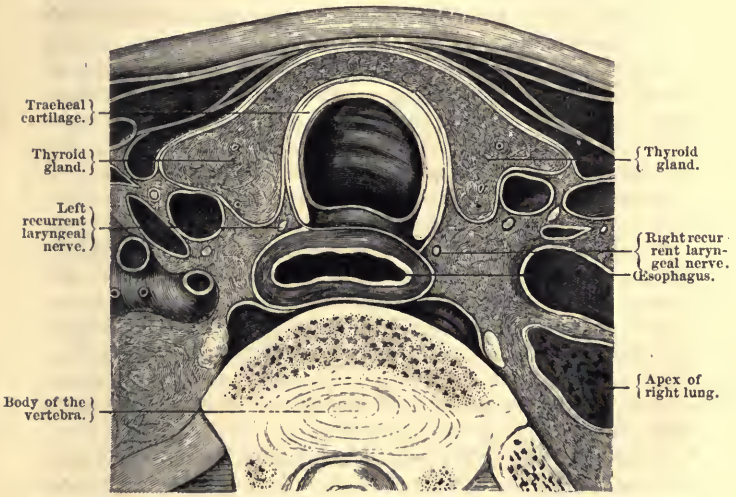


FIG. 89.—TRANSVERSE SECTION OF THE NECK OF A MAN TWENTY-FIVE YEARS OLD AT THE HEIGHT OF THE LOWER SURFACE OF THE FIRST DORSAL VERTEBRA.

(From Ziemssen, after Braune.)

similar kind. Bäumler[3] relates a unique case in which bilateral paralysis of the vocal cords followed a large pericardial exudation in a debilitated syphilitic subject. The phenomenon appeared to be due to pressure on both recurrent nerves from the crowding together of the soft parts by the pericardial exudation, a greatly enlarged heart, and distension of the right innominate and jugular veins.

*Symptoms.*—The phenomena attendant on paralysis of the

[1] "Berlin. Klin. Wochenschrift." 1873, Nos. 20, 21, and 27.
[2] "Annales des Malad. de l'Oreille, &c." 1878, No. 6.
[3] "Berlin. Klin. Wochenschrift." 1877, No. 23.

recurrent laryngeal nerves depend altogether on the seat and extent of the lesion. It must not be forgotten that the recurrent nerve consists of a bundle of filaments, which supply directly antagonistic muscles, viz., the abductors and the adductors of the vocal cords. When the nerves are uniformly involved, *i.e.*, when the whole trunks are affected, both the ab- and ad-ductor filaments are paralysed, and the vocal cords remain in what Ziemssen calls "*the cadaveric position*," *i.e.*, in a situation half way between the median position of phonation and the lateral position of deep inspiration, their immobility being very characteristic, and the diagnosis easy and conclusive. *No dyspnœa is present in such cases*,[1] and the voice may be weak or reduced to an almost inaudible whisper. In any case there is constant waste of breath present, and speaking is attended by a great increase in the amount of effort normally required, the excessive size of the glottis necessitating a greater degree of pressure to throw the vocal cords into vibration. The muscles of expiration, especially the abdominal, are therefore unusually strained, discomfort is felt at their thoracic attachments, and the patient quickly becomes exhausted. He cannot cough, expectorate, or speak properly, because in these acts it is necessary to close the glottis, and this he cannot accomplish. On forced inspiration a stridulous sound is often produced, which appears to depend on the arytenoid cartilages, the ary-epiglottic folds, or the flaccid vocal cords being thrown into coarse vibrations.

When the paralysis, whether bilateral or unilateral, is *incomplete*, the symptoms vary according to the degree of pressure on the recurrent nerve, and according to the nerve filaments which are most compressed. Thus, either the filaments going to the adductors or those supplying the abductors may be principally impinged upon. In the former case the abductor will keep the cord well to the side of the larynx, whilst in the latter the action of the adductors will maintain the cord near the median line. Experience has shown that the abductor filaments are more often pressed on than those going to the adductors. The reason of this is not at all obvious; it may be that the abductor filaments are more

[1] I take this opportunity of acknowledging the error I made in making an opposite statement many years ago ("Med. Times and Gaz.," April 3, 1869). It will be seen by reference to the case on which I made this erroneous assertion that the paralysis was incomplete, the abductor filaments of the nerve being alone implicated.

superficially situated than the adductors, or it may be that the adductors receive an increment of nerve-force from the superior laryngeal nerve; the fact that the arytenoideus or central adductor certainly receives some filaments from this nerve, supports the latter view. But whatever the cause may be it is undoubtedly true that pressure on the recurrent nerve, if not complete, is more apt to affect the abductor than the adductor filaments.[1] The vocal symptoms do not depend alone on the relation of the ab- and ad-ductors to one another, for the vocal cord may be either tense or relaxed, according as the crico-thyroid and thyro-arytenoid muscles are stretched or relaxed. Thus, if the tensors are paralysed at the same time as the abductors the symptoms are likely to be less active (that is, there is likely to be less stridor) than when the abductors are paralysed, but the tensors retain their vigour.

It occasionally happens that the paralysis is incomplete on one side. Under such circumstances a certain modification takes place in the symptoms, and the patient, instead of being aphonic, is enabled, by a distressing effort, to produce a considerable volume of sound. The tones formed are monotonous and, owing to the impossibility of the vocal cords being closely approximated, of a low register. The coarse vibrations produced by the paralysed and the paretic cord account for the phenomenon.

*Pathology.*—The pathology of these affections has been greatly encroached upon in considering their etiology. As regards their morbid anatomy, however, the changes found in the post-mortem room consist of alterations in the normal condition and structure of the diseased muscles and nerves. The recurrents and their branches are often almost completely atrophied, the proper nerve substance having disappeared, and the neurilemma alone remaining. In other cases the nerves are found to have undergone fatty degeneration to a greater or less extent. According to Ziemssen, it is sometimes possible to demonstrate, in the case of partial peripheral paralysis, a degeneration limited to a single nerve fibre. As regards the affected muscles, they also undergo retrograde metamorphosis, and, as a rule, atrophy *pari passu* with the changes in the nerve structures.

[1] The relatively greater disposition to implication of the abductor filaments was illustrated by my cases (Nos. xix. and xx.: "Hoarseness and Loss of Voice, &c."), as long ago as 1868, and has since been confirmed by many other cases—especially a case by Schech, loc. cit.

A case has been reported by Dr. George Johnson[1] and another by Dr. Bäumler[2] in which pressure on one pneumogastric nerve was accompanied by paralysis not only on the side on which the nerve was pressed upon, but also on the opposite side. In both these cases the abductors were principally affected. Johnson has suggested that there is in these cases a reflex paralysis, the afferent fibres of the nerves carrying back the irritation to the nuclei of the spinal accessory, from which the pneumogastric receives most of its motor fibres. Dr. Lockhart Clark[3] has demonstrated the remarkable decussation of the nuclei of the spinal accessory nerve, and Johnson thinks that this arrangement accounts for pressure of one pneumogastric nerve causing paralysis of the muscles on the opposite side. This explanation has not been generally accepted, and it must be admitted that when one pneumogastric nerve is pressed upon, the muscles on the opposite side are not generally affected, but, on the other hand, appear to compensate to some extent. It is more probable that in such cases as that reported by Dr. Johnson, central disease is set up, and the nuclei of the spinal accessory nerve become actually diseased.

*Prognosis.*—This will depend mainly on the cause which gives rise to the paralysis, but if the paralysis is complete or the abductor filaments mainly affected, the local condition is attended with great danger.

*Treatment.*—This must be directed against the cause of the paralysis. Goitres may be actively treated by appropriate remedies, the progress of aneurisms must, as far as possible, be checked, and the suffering of cancer alleviated; at the same time the nutrition of the muscles may sometimes be kept up by faradism and galvanism. When the paralysis mainly affects the abductor filaments and there is dangerous dyspnœa, tracheotomy must be performed.

## CASES ILLUSTRATING COMPLETE AND PARTIAL BILATERAL PARALYSIS OF THE RECURRENT NERVES.

*Case* 1. *Complete Paralysis of both Recurrents from Cancer of the Thyroid Gland.*—Mary Ann L., aged fifty-six, was admitted into the Hospital for Diseases of the Throat in November, 1869, suffering from an enlarged thyroid gland, loss of voice, shortness of breath, and violent paroxysms of coughing. On laryngoscopic examination both vocal cords were seen to be fixed in the cadaveric

[1] "Transactions of the Roy. Med.-Chir. Soc." vol. lviii. p. 29.
[2] "Transactions of Pathological Society," vol. xxiii. p. 66.
[3] "Philosoph. Trans." 1868, Part I.

position, being neither abducted in inspiration, nor adducted in vocalization. The patient's general condition was very cachectic, and the neck measured seventeen inches round. The thyroid gland was very hard and nodular, and on the left side the skin was dark and inclined to ulcerate. Ten days later an ulcer was found in this situation, and after repeated hæmorrhages the patient died three months after her admission.

On post-mortem examination a cancerous tumour was found completely obliterating both recurrent nerves. On examining the larynx the posterior and lateral crico-arytenoids on both sides were found to be greatly wasted, the transverse striation of these muscles being in parts very imperfect; the arytenoideus proprius alone seemed to be healthy.

*Case* 2. *Pressure on both Recurrents by Aneurisms, giving rise to* **Bilateral Paralysis of the Abductors.**—C. J., aged fifty-one, was admitted into the Hospital for Diseases of the Throat on the 15th March, 1869, suffering from dyspnœa, stridulous breathing, and slight spitting of blood. His voice was weak, but phonetic, and he had some difficulty of swallowing. On examination with the laryngoscope, both vocal cords were found to be in a state of adduction, being about $\frac{1}{16}$th of an inch apart; on phonation the vocal cords approximated. On percussion of the chest, dulness was found over the manubrium sterni, extending on the right side to the clavicle, on the left side over one inch of the space between the first and second ribs at its sternal extremity; above, the dulness did not reach quite to the margin of the sternum, and below terminated on a level with the second ribs. An aneurism was diagnosed, but the dyspnœa being very severe, and evidently due to nerve pressure, tracheotomy was performed by Mr. Evans on the 27th March. The patient made a good recovery, and left the hospital at the end of April in a feeble condition, wearing the tube, the paralysis of the abductors remaining. A fortnight later he was admitted with violent hæmoptysis, of which he died forty-eight hours afterwards. On post-mortem examination two aneurisms were found. One very large, commencing in the ascending aorta, and involving the innominate right subclavian artery, pressed, at its upper and outer part, on the right recurrent nerve and slightly on the right pneumogastric nerve. The second smaller aneurism involved the under and posterior surface of the descending portion of the arch of the aorta, and slightly pressed on the left recurrent nerve. On examination of the larynx, the posterior crico-arytenoids on both sides were found to have undergone fatty degeneration, so that there was very little of the true muscular substance remaining. The other muscles of the larynx on both sides were healthy, the striæ being well marked.

*Case* 3. *Pressure on both Recurrent Nerves by Cancer of the Œsophagus, giving rise to* **Bilateral Paralysis of the Abductors.**—Thomas B., aged sixty-seven, applied at the Throat Hospital, October, 1870, on account of difficulty of swallowing and shortness of breath. A laryngoscopic examination showed paralysis of the abductors. The adductors appeared to act perfectly, but the mucous membrane of the larynx was a little congested, and the voice was husky. It was found impossible to pass any bougie into the œsophagus, owing to a stricture in the upper third of the passage. This

patient died about ten days later. On post-mortem examination the canal of the œsophagus was found reduced to such narrow dimensions that a small probe could only just be passed through it. The walls of the œsophagus and the surrounding tissues were occupied by a cancerous growth, which proved on microscopic examination to be an epithelioma. The exit of the recurrent nerves could not be traced from the cancerous mass, although they were readily followed into it on each side. The abductor muscles were found to be greatly reduced in size and presented signs of fatty degeneration. The other muscles of the larynx were healthy, with the exception of the left thyro-arytenoid muscle, which showed signs of molecular transformation.

*Case* 4. *Pressure on both Recurrent Nerves by an enlarged Thyroid Gland, giving rise to* **Bilateral Paralysis of the Abductors.**—A. F., aged fifteen, a tall lad, of rather delicate appearance, was admitted into the Throat Hospital, October 1, 1878, suffering from stridulous breathing, which had been coming on for four months. When perfectly quiet he could breathe fairly well, but on the slightest exertion he experienced great dyspnœa, and during sleep made a loud noise in his breathing. On examining the neck a moderate sized, but very hard, bilateral goitre was perceived, and on using the laryngoscope the abductors of the vocal cords were found to be paralysed on both sides. The adductors did not seem to be at all affected, and the voice was perfectly normal. By varied treatment, extending over several months, the bronchocele was cured, and the action of the vocal cords became natural.

*Case* 5. *Pressure of an Aneurism on both Recurrents, giving rise to* **Bilateral Paralysis of the Abductors.**—T. E., aged sixty, was admitted under my care at the Hospital for Diseases of the Throat on November 27th, 1876. He was quite well up to six months ago, when he caught cold and experienced shortness of breath and a cough. Five weeks before coming to the hospital he noticed difficulty of swallowing. On laryngoscopic examination the vocal cords were seen, in ordinary inspiration, to remain nearly approximated, though in forced inspiration there was a narrow triangular space between them; on vocalization they did not completely approximate. On examination of the chest, slight pulsation was perceived above and below the right clavicle, and still slighter pulsation in the same situation on the left side. Respiration was everywhere feeble. The action of the heart was irregular, the normal sounds being replaced by murmurs, which were heard very distinctly, not only in the cardiac region but also above and beyond the right clavicle near the acromion. Aneurism and cardiac hypertrophy were diagnosed. The patient gradually got worse, the difficulty of breathing and swallowing increasing, and rapid wasting taking place. Death occurred soon afterwards, and on post-mortem examination there was found to be great hypertrophy of the heart, aneurismal dilatation of the first part of the aorta, chronic pneumonia, and enlargement of the bronchial glands. The last-named were enveloped in abundant firm connective tissue, which compressed both recurrent nerves. The trunks of the pneumogastric nerves were normal. The abductors of the vocal cords were very much wasted in comparison with the other muscles of the larynx, but no microscopic examination was made. (An abstract of this case was published in the "Clin. Soc. Trans.," l.c., by Dr. Semon.)

### UNILATERAL PARALYSIS.

*Etiology.*—Paralysis of one of the recurrent laryngeal nerves from local mechanical causes is not uncommon, owing in a great measure to the long course pursued by the main trunks of these nerves before dividing into their several branches. The relations of the two nerves are well shown in the annexed drawing (Fig. 90). The left recurrent, arising

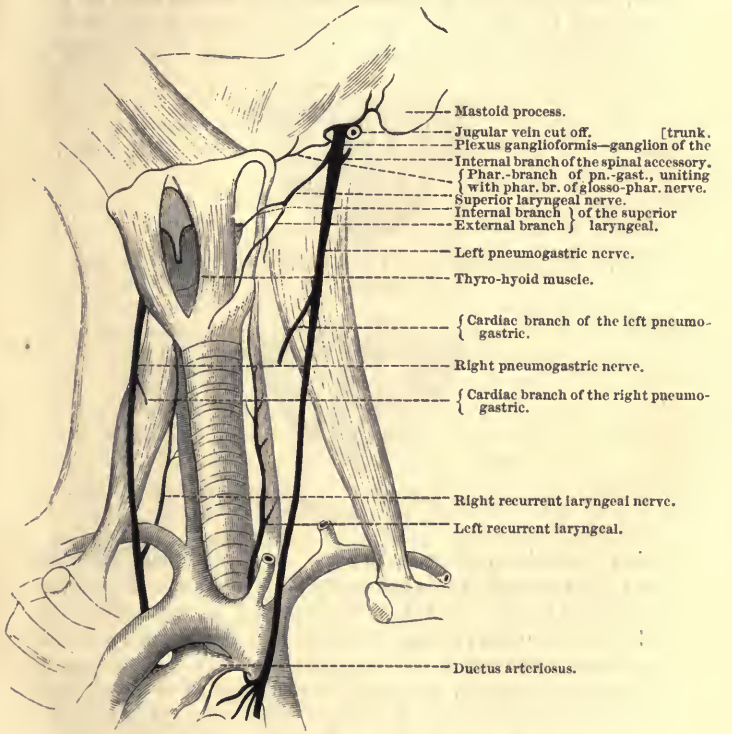
Mastoid process.
Jugular vein cut off.
Plexus ganglioformis—ganglion of the trunk.
Internal branch of the spinal accessory.
Phar.-branch of pn.-gast., uniting with phar. br. of glosso-phar. nerve.
Superior laryngeal nerve.
Internal branch of the superior laryngeal.
External branch of the superior laryngeal.
Left pneumogastric nerve.
Thyro-hyoid muscle.
Cardiac branch of the left pneumogastric.
Right pneumogastric nerve.
Cardiac branch of the right pneumogastric.
Right recurrent laryngeal nerve.
Left recurrent laryngeal.
Ductus arteriosus.

FIG. 90.—THE LARYNGEAL BRANCHES OF THE PNEUMOGASTRIC NERVE.
(From Ziemssen, after Henle.)

deepest in the chest below the arch of the aorta, is especially exposed to pressure by aneurisms, enlarged bronchial glands, and other tumours in the mediastinum. On the other hand, the right recurrent, on account of its lying for a part of its

course in close proximity with the apex of the right lung, may be compressed by thickening of the tissues in this situation. Dr. Mandl[1] states that whilst in fifty-two cases where the apex of the right lung alone was affected, fifty of the patients were hoarse, in thirty-two cases where the left apex was affected, only one of the patients was hoarse. Dr. Mandl accounts for this difference by reminding us that whilst the left recurrent nerve winds round the aorta, the right recurrent passes in close contact with the apex of the lung, and is therefore likely to be pressed upon by the morbid deposit, or the pleuritic inflammation at the apex, to

FIG. 91.—PARALYSIS OF THE LEFT RECURRENT NERVE AS SEEN IN INSPIRATION.

FIG. 92.—PARALYSIS OF THE LEFT RECURRENT NERVE AS SEEN IN PHONATION.

which phthisis so often gives rise. I pointed out, however, some years ago,[2] that this enormous preponderance of paralysis of the right vocal cord has not occurred in my experience, and further observations confirm my earlier conclusions. The most common cause of aphonia in the early stages of pulmonary consumption, indeed, is weakness of the expiratory muscles and feeble tension of the vocal cords, and is not of a neurotic character at all. (See Laryngeal Phthisis.) Either nerve may suffer from cancer of the œsophagus, and perhaps of all causes, this is the one most frequently in operation. The enlargement of a deep cervical gland, as well as malignant tumours in the neck, also often cause unilateral paralysis,

[1] "Gazette des Hôpitaux," No. 135. 1862.
[2] "Hoarseness and Loss of Voice," p. 17.

and mediastinal tumours, such as cancers, sarcomas, fibromas, and lymphomas of the bronchial glands, act in the same way.

The *symptoms* of this affection are manifest, for the condition can immediately be recognized by the laryngoscope. When there is complete paralysis of the nerve the affected vocal cord, on attempted phonation, remains in the cadaveric position (see Fig. 92), whilst the healthy cord is adducted to, or even beyond, the median line, one corniculum laryngis often crossing its fellow. Compensation is thus made to some extent for the inaction of the paralysed cord on the healthy side (see Fig. 94). According to Kappeler,[1] on forcibly striking a high note, the healthy vocal cord may even be dragged over so as to lie on the paralysed cord. In speaking of bilateral paralysis, it was remarked that in the early stages, and often during the entire period, the abductor is more affected than the adductors of the vocal cords.[2] This observation applies to the affection when it is limited to one side. Hence stridor is more often a symptom than aphonia or dysphonia. The voice of the patient may be completely lost, but it is more often harsh and discordant, and on the slightest strain, when an increased effort is made, it is very liable to break into falsetto tones. This is due to the unequal vibrations of the vocal cords, and to the abnormal way in which they approximate.

*Pathology.*—The observations made under this head in speaking of the bilateral affection are applicable here.

*Prognosis.*—The ultimate issue of any case naturally depends on the cause of the paralysis, but the danger of the laryngeal condition depends on whether the paralysis is complete, involving the whole trunk, or whether it is partial, involving the filaments going to the abductor alone. In the latter case there may be dangerous dyspnœa.[3]

*Treatment.*—It is useless to treat the laryngeal symptoms, except when the abductor alone is affected; then tracheotomy may be required. The cause of the affection must, however, if possible, be grappled with. Cases of this disease are so common, and have so frequently been reported in the medical journals, that I do not think it necessary to append illustrations. One example only is given, partly on account

[1] Loc. cit.

[2] See Cases 1 and 2, reported by me in the "Med. Times and Gaz." vol. i. p. 356. 1869.

[3] Ibid.

of the obscurity of its etiology, but principally because the illustration shows the crossing of the cornicula in phonation.

*Paralysis of the Left Recurrent Nerve from Unknown Cause.*—Sarah F., aged forty-one, admitted into the London Hospital, April 2nd, 1867, suffering from dysphonia. The hoarseness had existed from childhood, and came on after measles. No evidence of aneurism, thoracic tumour, or glandular enlargement. On laryngoscopic examination, the left vocal cord was seen, in attempted phonation, as well as in quiet respiration, to be immovably fixed in the cadaveric position. (For further particulars see "Hoarseness and Loss of Voice," p. 41.)

FIG. 93.—INSPIRATION.

FIG. 94.—ATTEMPTED PHONATION.

(The right arytenoid cartilage is seen to pass in front of the left, and the right vocal cord to pass beyond the median line to compensate for the inaction of the left cord.)

## PARALYSIS OF INDIVIDUAL LARYNGEAL MUSCLES.

It has already been pointed out that individual fibres of the nerves supplying the laryngeal muscles may be implicated either in the medulla, in the main trunks, or the so-called branches, but in addition to these causes of paralysis, loss of power sometimes *appears to arise* from simple myopathic change. Whether the affection under these circumstances is essentially muscular, or whether the nervous system, though apparently healthy, is in reality at fault, has not at present been determined. It is quite possible that microscopic research may at a future period discover histological changes in the nerves which are beyond our present means of detection. On the other hand, there is no doubt that muscles undergo idiopathic changes of a degenerative character quite independently of nerve lesions. This is con-

stantly noticed in the case of the heart, and Rehn[1] has well observed that the abdúctors of the vocal cords, the laryngeal muscles which most frequently suffer from degenerative changes, resemble the heart in their remarkable and almost constant action. It may further be stated that some diseases, which are usually regarded as neuropathic, are, nevertheless, considered by some eminent neurologists to be primarily myopathic. Thus Friedreich[2] maintains that in progressive muscular atrophy the primary lesion is in the muscles, and that the affection of the cord is only secondary, the muscular atrophy originating in myositis. Again, in the case of pseudo-hypertrophic muscular paralysis, Dr. Gowers[3] has argued with remarkable ability that there is congenital, nutritive and formative weakness of the muscle-substance, and that the degeneration in the grey network of the lateral columns is of a secondary character. Further, in some cases of chronic rheumatism, atrophy occurs without any evidence of nerve-implication. It may also be incidentally pointed out that muscular fatigue from over use of the laryngeal muscles—especially of the tensors—is one of the most common causes of hoarseness; and that it would certainly be stretching a point to regard these cases of muscular fatigue as neuroses. Taking a broad view of muscular paralysis and atrophy, the case stands thus: Muscular atrophy from disease of the medulla, spinal cord, and motor nerves *is proved;* whilst there is considerable probability that such atrophy *may exist* without any such preceding neurosis. The questions merit elucidation, and the sharply-defined functions of some of the laryngeal muscles and the peculiar arrangements of their nerve-supply make them a favourable subject for further investigation.

Under the heading we are now considering are included only those cases in which there is apparently an entire absence of evidence of nerve change. It only embraces two classes: (1) Those in which there is distinct muscular atrophy; and (2) those in which the muscles are not thrown into operation from suspended or perverted volition (hysteria). Obviously the two sets of cases are totally distinct, and yet as they do not belong to any of the previous divisions, it is con-

[1] "Deutsches Archiv für Klin. Medicin." vol. xviii.

[2] "Ueber progressive Muskelatrophie:" Berlin, 1873. See also cases in support of this view by Knoll ("Wien. Med. Jahrb." 1872, p. 1), and Malmsten ("Schmidt's Jahrb." vol. cxvii. p. 31).

[3] "On Pseudo-Hypertrophic Muscular Paralysis." Churchill, 1880.

venient to consider them together. To make further subdivisions would only be to introduce unnecessary complications. Myopathic changes have hitherto been principally observed in connection with bilateral paralysis of the abductors of the vocal cords, but cases occur in which one abductor alone is affected, and others in which, whilst the abductors are principally paralysed, the action of the adductors is also slightly defective. When both ab- and ad-ductors are paralysed, the *primâ facie* view, of course, would be in favour of the existence of disease in the recurrent nerve, or in some of the nerve-fibres between the brain and the affected muscles, but there is no reason why the antagonistic muscles themselves should not suffer simultaneously from myopathic change.

## BILATERAL PARALYSIS OF THE ABDUCTORS OF THE VOCAL CORDS.

*Latin Eq.*—Paralysis bilateralis abductorum chordarum vocalium.

*French Eq.*—Paralysie bilatérale des abducteurs des cordes vocales.

*German Eq.*—Doppelseitige Lähmung der Glottisöffner.

*Italian Eq.*—Paralisi bilaterale degli abduttori delle corde vocali.

Definition.—*Inaction of the abductors on both sides, causing the vocal cords to remain near the median line on attempted inspiration and giving rise to dyspnœa and stridulous breathing.*

*History.*—The fact that paralysis of the abductors of the vocal cords may give rise to serious dyspnœa was clearly recognized by Etmüller,[1] and the loss of power in these muscles was alleged by Dr. Ley [2] to be the essential cause of laryngismus. Trousseau[3] subsequently referred to this condition as a probable cause of the occasional difficulty of dispensing with the canula after tracheotomy, and it has recently been noticed by Professor Gerhardt[4] in a boy on whom that operation had been performed. To the same distinguished physician belongs the honour of first (1863) observing a case of paralysis of the abductors with the laryngoscope (p. 438). His first case was, however,

[1] "De Suffocatione convulsiva," vol. ii. p. 226.
[2] "Laryngismus Stridulus." London, 1836.
[3] "Clinical Medicine," "New Syd. Soc. Trans." vol. ii. p. 609.
[4] "Handb. d. Kinderkrankh." 2nd Edition, p. 326.

complicated by a double bronchocele and an asymmetrical position of the arytenoid cartilages, circumstances which point to bilateral pressure on the recurrent nerves, and even to direct pressure on the larynx rather than to a simple myopathic affection. In 1866 a case was published by Dr. Hughlings Jackson (See foot-note), in which I described the laryngoscopic appearances. In this instance the affection was strictly confined to the abductor muscles, which were found greatly atrophied after death, whilst the nerve-structures were perfectly normal. Two years later I recorded a second equally typical example, and soon afterwards cases were reported by Duranty, Biermer, Pentzoldt, and Feith (See foot-note); in 1872 Riegel reported a very interesting case in which there was bilateral paralysis of the abductor filaments of the recurrent nerves. Shortly afterwards, however, this physician published an undoubted case of myopathic paralysis of the abductors in a phthisical patient, in which there was no evidence of nerve lesion. Many other cases[1] have since been reported, but con-

[1] The following is the bibliography of cases up to the present time. (In making this list I have derived much assistance from Professor Burow's excellent paper, referred to below, and I am further indebted to the Professor for several references which he has kindly communicated to me privately; I have also to thank Dr. Pell for full details of his case.)

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| Mackenzie and Jackson: "Med. Times and Gazette," Dec. 15. | 1866 |
| Mackenzie: "Hoarseness, Loss of Voice, &c." p. 34. | 1868 |
| Duranty: "Diagnostic des paralysies motrices des muscles du larynx," Paris. | 1869 |
| Biermer: "Volkmann's Sammlung Klin. Vorträge," No. 12. | 1870 |
| Pentzoldt: "Deutsches Archiv für Klin. Medizin," vol. xiii. p. 107. | 1874 |
| Feith: "Berliner Klin. Wochenschrift," No. 49. | ,, |
| Tobold: "Laryngoskopie u. Kehlkopfkrankheiten," Berlin | ,, |
| Riegel: "Volkmann's Sammlung Klin. Vorträge," No. 95. | 1875 |
| Heinze: "Archiv der Heilkunde." xvi. p. 77. | ,, |
| Warren: "Boston Med. and Surg. Journ." Aug. 31. | ,, |
| Rehn: "Deutsches Archiv für Klin. Medizin," vol. xviii. | 1876 |
| v. Ziemssen: Ibid. | ,, |
| Böcker: "Deutsche Med. Wochenschrift," Nos. 20 and 21 | 1877 |
| Klemm: (2) "Archiv der Heilkunde," August 1st. | ,, |
| Knight: "Boston Med. and Surg. Journ." No. 8. | ,, |
| Glynn: "The Lancet," September 1st. | ,, |
| Smith: "American Journal of Med. Sciences," Jan. | 1878 |
| Schreiber: "Deutsche Med. Wochenschrift," Nos. 50 and 51 | ,, |
| Semon: "Trans. of Clin. Soc." vol. xi. | ,, |
| Smith: "Brit. Med. Journ." July 13. | ,, |
| Burow and Meschede: "Berliner Klin. Wochenschrift," No. 17. | ,, |

sidering the zeal of laryngoscopists, and the enormous number of observations which have been made during the last twenty years, the affection must be looked on as rare.

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| Lefferts: "New York Med. Journ." Dec. | 1878 |
| Fränkel: "Berliner Klin. Wochenschrift," No. 10. | ,, |
| Guttmann: Ibid. | ,, |
| Semon: "Trans. of Clin. Soc." vol. xii. | 1879 |
| Cohen: "Diseases of the Throat," New York, 2nd edition, p. 654 | ,, |
| Burow: "Berlin. Klin. Wochenschrift," Nos. 33 and 34 | ,, |
| Jurasz: "Deutsche Med. Wochenschrift," Nos. 14 and 15 | ,, |
| Reichert: "Langenbeck's Archiv," Bd. xxiv. Hft. 3 | ,, |
| Browne: "Proceedings of Med. Soc. of Lond." vol. iv. p. 223 | ,, |
| Pell: "Weekblad van het Nederlandsch tydschrift von Geneskunde," No. 7 | ,, |
| Ott: "Prag. Med. Wochenschrift," No. 15 | ,, |
| Whipham: "St. George's Hosp. Reports" | ,, |
| Hayes and Semon: "Dub. Journ. of Med. Sci." | 1880 |
| Woakes: Unpublished case | ,, |

In Dr. Woakes' case the patient was a widow, aged 46, who came under his care at the Throat Hospital, in October, 1878, and on whom tracheotomy was performed in November. The patient had suffered from constitutional syphilis, but did not derive benefit from iodide of potassium, either before or after the operation. With the exception of being obliged to wear a canula, she is now in good health.

In addition to these cases there are several others included in Burow's table and elsewhere reported, which, in my opinion, ought not to be admitted here. Some of these are of a purely mechanical character, whilst others are distinctly due to disease of the medulla, or to pressure on the pneumogastric nerve or its branches. In the mechanical cases, the muscular affection is accidental, whilst in cases of disease of the nerve-centres or afferent nerves, the paralysis ought to be considered under that division of the nervous system which was the *fons et origo mali*. Accordingly, I exclude a case of mine ("Growths in the Larynx," p. 177), in which a subglottic growth pressed on the under surface of the vocal cords and prevented their being abducted. I must also reject another of my cases reported by Dr. Semon (loc. cit.) in consequence of the disease having been proved to be due to pressure on both recurrent nerves. For the same reason I exclude Riegel's first case ("Berlin. Klin. Wochenschrift," Nos. 20 and 21, 1872, and No. 7, 1873), and Koch's case ("Annales des malad. de l'oreille, etc." No. 6, 1878); and for the reasons stated in the text, I am also obliged to reject Gerhardt's case. I cannot accept Werner's case ("Würzburg. Med. Corresp." No. 10, 1857), on account of its doubtful (pre-laryngoscopic) character, nor Türck's case ("Klinik." p. 461) in which the bifurcation of the trachea having been visible, it is scarcely possible to imagine that there could have been any decided narrowing of the glottis. One of Pentzoldt's cases is rejected because it appears to belong to the same category as several of my cases related under the heading of "Paralysis from Disease of the Medulla" (p. 426), and Beverley Robinson's case, as already pointed out (p. 426, foot-note) belongs to the same subdivision. Martel's case ("Annales des maladies de l'oreille, etc." vol. v. No. 4, p. 200), is excluded on account of its

*Etiology.*—Neuropathic and myopathic cases having been hitherto mixed up together, the etiology of the disease has been rendered very obscure. The affection is much more common in men than women, and in adults than children. The abductors are probably more frequently paralysed because they are more exposed to accidental injury than any of the other laryngeal muscles. Thus the thyro-arytenoidei are well protected by the thick vocal cords, and the crico-arytenoidei laterales, or adductors, are shielded by the inferior alæ of the thyroid cartilage. The crico-thyroid muscle, it is true, has a very exposed position, but it is protected by the fasciæ and skin of the neck, which afford a better defence than the thin mucous membrane covering the abductors. The arytenoideus, it must be granted, occupies a position corresponding to that of the crico-arytenoidei postici, but the vertical plane in which it lies is considerably in advance of that of the latter muscles, and hence it is much less exposed to the injury which may result from swallowing food containing hard or pointed substances, or drink of too cold, too hot, or too irritating a character. It will be seen that in three of my cases exposure to cold was probably the starting point of the affection. In one of these cases the patient had suffered from rheumatic fever. Muscular exertion was the apparent cause in one case, whilst in another the paralysis may have had a similar origin, as the patient was a gymnast. In another instance the affection may have been developed through muscular exertion, the subject having been a lawyer constantly engaged in speaking. In many cases the sequence of events is probably as follows:—The abductors become accidentally inflamed from cold or from traumatic injury, such as may arise from pressure in swallowing, or the irritating quality of certain kinds of food or drink. The muscles, being injured, ought to be kept perfectly at rest, but every movement of the body requiring the slightest exertion implies a voluntary contraction of the abductors. Even in the comparatively passive act of sighing these muscles are largely called into

unsatisfactory character and insufficient detail. It is highly probable that even in my table (reduced as it is when compared with that of Burow), some cases are included in which a nerve-lesion actually existed, and which therefore ought properly to be placed in one of the preceding categories. Thus there are several cases in which no post-mortem examination was made, and in which had such a test been possible the classification might have been different.

play. Although the regular action of muscles in a state of health increases their nutrition and adds to their vigour, it will be readily understood that if a muscle is injured, its action will then bring about pathological changes of a degenerative character; and this is probably what frequently occurs in connection with the crico-arytenoidei postici. In Ott's[1] case a piece of meat was accidentally impacted at the orifice of the œsophagus, where it pressed on the abductors for twenty-four hours; and the accident gave rise to the train of phenomena such as have just been described. So gross and palpable an illustration of the starting-point of the affection has not been noticed in any other case, but it is highly probable that in other instances slighter injuries, perhaps not noticed at the time even by the patient, have been the initial events in the series of morbid changes. In some of the reported cases the disease has undoubtedly been due to syphilis—probably to a gummatous deposit in the muscles; whilst in a few it has been of an hysterical character.

*Symptoms.*—When a patient has a normal, or almost normal, voice, with freedom of expiration, but great inspiratory dyspnœa, much increased on the slightest exertion, and accompanied with great stridor in sleep, the disease must be suspected. With the laryngoscope the condition is very apparent, for on inspiration, instead of the vocal cords being abducted from the median line, they remain nearly approximated, the opening of the glottis forming a very acute isosceles triangle. The aperture may vary from a line to two lines or more. In forced inspiration the opening generally becomes smaller, and in forced expiration larger; but this is not invariably the case. In some instances the paralysis is partial; the vocal cords, on inspiration, remaining approximated in their anterior three-fourths, but separating posteriorly, and leaving a small equilateral triangle. Dr. Semon[2] suggests that this peculiarity is probably due to the internal fibres of the abductors maintaining their physiological activity, whilst the external ones are paralysed. Sometimes one abductor is more affected than the other, or

[1] Loc. cit.

[2] "Brit. Med. Journ." May 24th, 1879. See also Rühlmann: "Untersuchungen über das Zusammenwirken der Muskeln bei einigen häufiger vorkommenden Kehlkopfstellungen." "Sitzungsberichte der k.k. Academie der Wissenschaften." Wien, 1874, vol. lxix. 1—5 Heft.

the affection, originally unilateral, may become bilateral.[1] The vocal cords are sometimes slightly congested, but they are often perfectly healthy in colour. The voice is not generally much affected, but it may be slightly hoarse. If the patient does not move at all, the respiration may be little affected, but the least exertion brings on dyspnœa and stridulous breathing, with the rapid up and down movements of the larynx which characterize laryngeal obstruction; during sleep the respiration is almost invariably accompanied with loud stridor. The condition is in itself apt to produce constitutional symptoms, such as wasting and febrile excitement, and it is sometimes accompanied by paralysis of other parts. In children it produces symptoms not unlike laryngismus stridulus, and Dr. Ley[2] considered that laryngismus was always of a paralytic nature, but this was an error, as will be hereinafter shown. (See Spasm of the Glottis.)

*Diagnosis.*—The recognition of this affection is usually very easy, but spasm of the adductors of the vocal cords produces symptoms which to some extent resemble it. In cases of spasm, however, the vocal cords are constantly varying in the degree of adduction, whilst when paralysis is present the cords are quite immobile. Spasm, moreover, very rarely lasts long, and, instead of being increased in sleep, is generally relieved during a state of unconsciousness. These circumstances at once differentiate the two conditions. Mechanical causes may, however, sometimes lead to an erroneous diagnosis. Thus in a case under my care all the symptoms of paralysis of the abductors were produced by a sub-glottic growth. The case, indeed, was wrongly diagnosed to be one of paralysis of the abductors, and it was only after tracheotomy had been performed, that the growth was discovered. Such rare affections as anchylosis and growing together of the arytenoid cartilages may also simulate paralysis,[3] and, indeed, the disuse of the muscles from these causes may lead to their atrophy. Another source of error arises from the fact that in some persons, especially those of a nervous and hysterical temperament, when their attention is directed to the point, forced inspiration gives rise to approximation of the vocal cords, instead of its causing their separa-

[1] See a case reported by Cohen: "Diseases of the Throat," 2nd Edition, p. 654.

[2] An "Essay on Laryngismus Stridulus." London, 1863.

[3] See Sidlo's case, p. 404.

tion. This source of fallacy is overcome by keeping the mirror for some time in the throat and allowing the patient to breathe naturally; the normal action of the cords will then be seen.

*Pathology.*—In three cases seen by me during life, changes were found in the muscles after death, whilst the structure of the nerves and brain was perfectly healthy. In one case the abductors were pale, thin, and atrophied; in another instance one abductor showed signs of fatty degeneration, its fellow being apparently normal; whilst in the third case there was very little of the muscular structure remaining, the few fibres that were left being bathed in pus. In Riegel's case of true myopathic paralysis, "the posterior crico-arytænoidei muscles were of most striking, almost white, sinewy appearance, showing hardly a trace of muscular tissue, while all the other laryngeal muscles seemed normal. On microscopic examination the former showed much connective tissue lying between the muscular bundles, which were still preserved, but which revealed indistinct transverse striations and granular cloudiness."

*Prognosis.*—The prognosis is generally very serious, as it is only in cases of hysteria or syphilis that any other treatment than tracheotomy can be relied upon. If this operation, however, is performed in due time there is no reason why the patient should not remain well for many years. One of my patients has worn a tracheal canula for twelve years, and, with this exception, is in perfect health. In dealing with this affection it must not be forgotten that continuous narrowing of the glottis is likely to lead to serious disturbance of many important organs. Thus the interchange of gases in the lungs is retarded, the pulmonary circulation impeded, and blood driven back to the right side of the heart. It is unnecessary to dwell on the well-known structural changes which this state of things implies. Attention, however, must be called to the fact that the obstructed respiration is also likely to interfere with the cerebral circulation and to give rise to organic disease of the brain; it is quite possible that in some cases, where the paralysis of the abductors appeared to be due to a lesion of the medulla, the central affection was the final feature in the train of phenomena here indicated.

*Treatment.*—Whether the paralysis of the abductors constitutes the disease itself, or whether, as in the cases reported in previous sections, it is merely a symptom of a diseased condition on the part of some portion of the nervous system,

"the operation of tracheotomy should be performed without delay to save the patient from suffocation." Such were the words I employed in describing this disease in 1868,[1] and I have little to alter. The fact, however, that a few cases have been reported in which recovery took place, in consequence of the disease having been due to hysteria, syphilis, or catarrh, shows that it is not absolutely necessary to open the windpipe in every instance. The proper line of action has, indeed, been well laid down by Dr. Semon, who remarks[2] that, unless *objective widening of the glottis* be obtained by treatment *within a short time*, tracheotomy ought to be performed without delay. It would appear that that operation is more likely to be required in the purely myopathic cases, than in those in which the muscular change is of a secondary nature. Thus, in my own experience, out of eight cases of myopathic paralysis tracheotomy was necessary four times, whereas in four cases in which the atrophy was due to central disease, the trachea was not once opened, and in four cases in which the atrophy was due to pressure on both recurrent nerves tracheotomy was only once performed. This difference may perhaps be due to the adductors being often slightly affected in cases of nervous origin, whilst in the purely myopathic cases, the affection being generally limited to the abductors, the dyspnœa is more extreme. In two or three of my neurotic cases, however, it must be admitted that the patients died through their unwillingness to submit to tracheotomy. Out of thirty-four cases collected by Burow,[3] tracheotomy was performed seventeen times, and out of six cases occurring in the practice of Tobold[4] the trachea was thrice opened. In neither of these series of cases are the etiological features considered in reference to the subject of tracheotomy.

In slight cases, or in severe ones, after tracheotomy has been practised, both constitutional and local treatment may be tried. Strychnine may be employed hypodermically ($\frac{1}{60}$th of a grain once or twice a day), and electricity, both in the form of faradism and galvanism, may be used with the aid of my abductor electrode (page 252, Fig. 40, *g*). These agents are, however, seldom of any avail. The appropriate remedies for hysteria, catarrh, and syphilis, must be employed where either of these affections is the cause of the paralysis.

[1] "Hoarseness and Loss of Voice," &c. p. 33.
[2] "Trans. Clin. Soc." 1879, vol. xii.
[3] Loc. cit. [4] Op. cit.

## CASES ILLUSTRATIVE OF BILATERAL PARALYSIS OF THE ABDUCTORS.

In addition to the following eight cases, I have reported four others under "Disease of the Medulla" (page 427), and four under "Bilateral Paralysis of the Recurrents" (page 443), making altogether sixteen cases of bilateral paralysis of the abductors in my own practice.

*Case* 1.—T. T., aged thirty-five, was admitted into the London Hospital, under the care of Dr. Hughlings Jackson, December 5, 1864, on account of great difficulty of breathing. The thorax appeared of natural size and capacity, and was normally resonant; the respiratory murmur was distinct, and heart sounds healthy. Each inspiration was accomplished with great difficulty, and attended by a crowing or croaking noise; expiration was normal. Two years previously, after a great muscular effort, sudden difficulty of breathing, with a noise on inspiration. This had remained more or less ever since, being much increased by exertion, and when in a reclining posture. Six months before coming under treatment the patient had been seized with giddiness, and had fallen down without becoming quite insensible. For about a week after this he had slight weakness and numbness in the left leg. Dr. Hughlings Jackson was kind enough to ask me to see the case, and on examination with the laryngoscope I found the following:—*On Inspiration.*—At its commencement, the vocal cords are separated to the extent of the rim of a sixpence; at its conclusion, they are approximated. *In Expiration.*—During the normal effort the vocal cords remain approximated; if it is forced, they separate to the extent of the rim of a penny. *Vocalization* is not materially affected, as the cords always remain in the position suitable for the production of sound. There is no organic disease of the larynx, that is to say, there is no tumour, ulceration, or cicatrix to interfere with the action of the cords. The patient continued to grow worse, and on December 23 laryngotomy was performed, but the man only survived a few hours.

At the post-mortem examination, conducted by Mr. Rivington, it was found that the cords were closely approximated. The mucous membrane of the glottis was perfectly sound. Dissection of the pneumogastric nerves, and of their superior and inferior laryngeal branches, failed to throw any light on the case, for they showed no irritation, pressure, or disease. The lateral crico-arytenoid and posterior crico-arytenoid muscles were carefully examined. The former were quite healthy, but the latter were pale, thin, and atrophied. An ordinary examination of the brain failed to reveal any alteration in its tissues. At the time I agreed with Dr. Hughlings Jackson in regarding this as a case of central disease —though there were no physical evidences of such disease—but further experience induces me to consider this view as incorrect.[1]

*Case* 2.—Judge S., aged sixty-one, came over from America in 1866 to consult me on account of great shortness of breath and slight hoarseness. He stated that for thirty years his voice had been weak, but that fifteen years ago, after delivering a charge of several

[1] For further details, see "Medical Times and Gazette," Dec. 15, 1866, p. 638.

hours' duration, he had experienced a sudden and severe spasm in the throat, from which, however, he recovered in a few hours. Since that time he had occasionally suffered from similar, but milder, attacks of the same sort. During the last seven or eight years his voice had become weak, and latterly, on the least exertion, especially talking or going upstairs, he had made a great noise in breathing. During sleep the noise (stridor) was so loud that it disturbed people in the adjoining rooms. At meals it often happened that "things seemed to go the wrong way," and then he had violent fits of coughing. All the symptoms had become considerably aggravated within the last five or six months, and within the last eight or nine weeks he had been troubled with a frequent croupy cough and slight expectoration, the latter occurring especially in the morning. Objectively the patient appeared weak and feeble, but, being a man of great natural energy, he could still endure a considerable amount of fatigue. He was thin and had a yellow complexion, resembling that seen in cases of malignant disease. There was no pain nor other symptoms of paralysis beyond those found in the larynx. Inspection of this part with the laryngoscope showed that on inspiration the vocal cords were scarcely at all abducted from the median line, the space between them not being more than one-sixteenth of a inch. In forced expiration the aperture appeared to be about one-eighth of an inch wide. In phonation the vocal cords, which were of a pearly-white colour, seemed to approximate. The appearances are portrayed in the annexed cuts. The most careful

FIG. 95.

FIG. 96.

PARALYSIS OF THE ABDUCTORS.

Fig. 95 shows the glottis in inspiration. Fig. 96 in forced expiration.

examination of the chest failed to detect any trace of disease in the thoracic organs. I recommended tracheotomy, but the patient would not submit to that operation, and the treatment was confined to the use of stimulating inhalations, an iron tonic, and cod-liver oil. He went to pass the winter in Italy, but more than a year later I again saw this patient, and found him wearing a canula. It appeared that he had taken cold in crossing the Alps, and was compelled to have tracheotomy performed at Geneva. His general condition was greatly improved, and there seemed to be rather more separation between the cords on inspiration. He of course continued to wear the canula. This gentleman presided at a large public dinner at Rochester, U.S., in the year 1878. He was quite well, though still obliged to wear the tracheal canula.

*Case* 3.[1]—Charles E., aged thirty-four, a gymnast, was admitted into the Hospital for Diseases of the Throat, under my care, on the 22nd November, 1876. He complained of constant difficulty of breathing, which was frequently much increased without any assignable cause. Eighteen years ago he had primary syphilis, but never had any secondary symptoms. Eight months ago he awoke in the morning with great difficulty of breathing, and had since frequently been attacked in a similar way in the day time; he had never previously been short of breath except under mental excitement. The patient now suffers from marked dyspnœa on inspiration, but his voice was normal; lungs and heart healthy. On laryngoscopic examination it was seen that the vocal cords were scarcely at all abducted on attempted inspiration, but remained near the median line; on phonation the vocal cords were properly adducted. At night his inspiration was attended with such a loud howling noise that it was heard all over the hospital. Tracheotomy was performed, but the patient died eight days afterwards from pneumonia. On making a post-mortem examination, the bases of both lungs were found to be hepatised. The mucous membrane lining the bronchi and trachea was very much congested. The heart and large vessels proceeding from it were healthy. The pneumogastric, superior laryngeal, and recurrent nerves were everywhere intact. On examining the muscles of the larynx, the crico-arytenoidei postici were found to have undergone degeneration, their numerous fasciculi showing no trace of striation. In the right muscle numerous fat globules were found, but in the left there was no evidence of oily matter; the other muscles were healthy. The post-mortem was conducted at the patient's residence, and no examination of the brain was permitted.

*Case* 4.—G. S., aged thirty, clerk, was admitted at the Hospital for Diseases of the Throat, February 2, 1877; his history was as follows:—About two years ago, on waking one morning, he found himself quite blind; he immediately went to a hospital, and at the end of two months quite suddenly recovered his sight. He only remained well, however, for three or four days, when he again became blind. He then went to another hospital, and remained in attendance for a year, but did not receive any benefit. He was told that his complaint was neuritis. He then placed himself under the care of Mr. Liebreich, at St. Thomas's Hospital, when he gradually improved, and ceased treatment in 1876. Soon after he began to suffer from attacks of vomiting, which often continued for three days and nights at a time, and he was also subject to constant headache and giddiness. Three months ago slight dysphagia set in, without any assignable cause; the voice remained normal. It was principally on account of difficulty of breathing, which was daily getting worse, that he came to the hospital. On examination all the organs were found to be healthy, though the circulation was slow (pulse sixty-four, and very weak); over the right carotid there was a systolic bruit, and a diastolic sound. On laryngoscopic examination the vocal cords were seen to remain near the median line; about one-eighth of an inch apart on inspiration. On phonation they were not completely adducted to the median line. Bromide of potassium was first ordered, and after a

[1] In order to avoid any confusion in statistics—especially the double enumeration of cases—I may remark that Cases 3, 4, 5, and 7 in this section were reported in abstract in "The Clin. Soc. Trans.," 1878, by Dr. Semon, at that time acting as my Clinical Assistant.

short time a mixture containing quinine and iron was given. The patient gradually improved, and at the end of six months the condition of the larynx was normal.

*Case 5.*—J. S., aged sixty-one, was admitted into the Hospital for Diseases of the Throat, April 5, 1877. About two years previously he had taken cold and was attacked with hoarseness and sore throat. This became gradually worse, although from time to time there were slight remissions. Eight months ago slight difficulty of breathing and a fatiguing cough accompanied profuse expectoration. From the commencement he had suffered from sub-sternal pains and palpitation of the heart. Ten years previously he had had an attack of rheumatic fever. On examination the heart and lungs were found to be healthy. A laryngoscopic examination showed paralysis of both abductors, whilst the adductors were only very slightly affected. The patient had slight difficulty of swallowing. Remedial measures failing to benefit the patient, tracheotomy was performed by Dr. Semon, and the patient left the hospital, June 23rd, wearing the canula. After some months the patient allowed the tube to be displaced, and not applying to the hospital for four or five days, it was found impossible to replace the tube without doing a second operation. This the patient refused to permit. He stated that he was much better, but a laryngoscopic examination did not show any material improvement. He has not since been heard of.

*Case 6.*—In September, 1877, I was requested by Mr. Roberts, of St. John's Wood, to see Mrs. W., aged forty-three, who was suffering from great dyspnœa and stridulous breathing. She stated that she enjoyed good health until the year previously, when she began to notice difficulty in breathing in going upstairs. This gradually increased, until the noise in breathing became so loud that it was heard all over the house. During sleep this was greatly intensified. On examining the chest, there was no evidence of any pulmonary or cardiac disease, nor any sign of aneurism. On laryngoscopic examination, the vocal cords were seen, on inspiration, to be nearly approximated. There was scarcely any congestion of the mucous membrane, and the general configuration of the larynx was perfectly normal. I recommended tracheotomy, but it was not agreed to by the patient. A year later I heard, accidentally, that this lady was occupying some temporary apartments in my neighbourhood, and that her loud breathing at night caused her to be a nuisance to all the other lodgers in the house.

*Case 7.*—James H., aged forty, admitted into the Throat Hospital under my care January, 1878, suffering from great dyspnœa. On laryngoscopic examination there was seen to be paralysis of the abductors and slight œdema over the arytenoid cartilages. The dyspnœa was so extreme, however, that I requested my clinical assistant, Dr. Semon, to perform tracheotomy at once. The patient, who rapidly became asphyxiated, died two minutes after the operation was performed, and artificial respiration did not succeed in restoring life. It may be mentioned that no anæsthetics were administered, and that there was no hæmorrhage. On post-mortem examination all the organs of the body were quite healthy, but an abscess was found in the posterior wall of the cricoid cartilage, which had caused atrophy of both abductors, and disintegration of the nerve-fibres in the immediate proximity of the muscle. In this case the primary lesion was no doubt the abscess, but whether the atrophy

of the muscles was entirely due to direct pressure of the abscess, or whether it was caused in part through the nerve supply being to some extent cut off by the pressure of the abscess on the nerve-fibres in close proximity to the muscle, it is impossible to say. It was subsequently ascertained that the disease came on suddenly twenty-one months ago, after exposure to cold, and the dyspnœa had increased steadily for thirteen months, and to a much greater extent during the last eight months. In the complete absence of any evidence of syphilis or phthisis, the case may be regarded as one of idiopathic perichondrial abscess.

*Case* 8.—Louisa O., aged twenty-nine, was sent to me by Mr. Charles Hurford, of the Caledonian-road, on April 7, 1879. She has been losing flesh for three years, but a year ago first noticed that her breathing was difficult and noisy, coming on after exposure to cold at night. She had been seen by several surgeons, but nothing has given her any relief, and during the last few weeks she has been getting much weaker. On laryngoscopic examination, it was seen that on inspiration the vocal cords scarcely moved from their median position.

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## Paralysis of One Abductor.[1]

Definition.—*Inaction of the abductor on one side, causing the corresponding vocal cord to remain near the median line on inspiration, and giving rise to more or less dyspnœa and stridulous breathing.*

*Etiology.*—The affection sometimes results from catarrhal inflammation, and I once saw it caused by injury to the muscle from the accidental impaction for two days of some false teeth. I have seen two cases (hereinafter related) in which syphilis was the cause of the paralysis.

*Symptoms.*—The condition can be readily recognized with the aid of the laryngoscope, for on directing the patient to inspire the affected cord is not abducted from the median line. Stridulous breathing and dyspnœa ensue on exertion, but, as might be expected, the symptoms are not so severe as when both cords are affected. The voice is not generally altered unless there is an accidental congestion.

*Diagnosis.*—The position of the affected cord on inspiration at once establishes the nature of the affection, but it is often impossible to tell during life whether the affection is myopathic or due to nerve pressure.

*Prognosis.*—The prospects of the patient in relation to restoration of function depend on the cause of the paralysis and its duration. If there is reason to suppose that the

[1] The cases in which this condition arises from pressure on the abductor fibres of one of the recurrent nerves have already been described (p. 447).

muscular fibres are actually destroyed, the case is, of course, hopeless. As a rule, a cautious prognosis should be given in cases of long standing; and it must not be forgotten that tracheotomy may be required.

*Treatment.*—In recent cases soothing treatment should be carried out by means of warm inhalations, and when the local inflammation has passed away faradism and galvanism may be carried out with my "abductor electrode," whilst in syphilitic cases iodide of potassium should be given. The simple imflammatory cases generally terminate favourably.

CASES ILLUSTRATING PARALYSIS OF ONE ABDUCTOR.

C. H., a man, aged fifty-three, admitted into the Throat Hospital, July 1st, 1871, suffering from slight dyspnœa, which he stated commenced three months previously. The larynx showed unmistakable signs of old syphilis, and the abductor on the left side was paralysed. Under a course of iodide of potassium the action of the abductor became normal at the end of three weeks.

S. E., a woman, aged forty-one, admitted into the Throat Hospital, January, 1874, complaining of shortness of breath. She had a large cicatrix in the pharynx, and the edge of the epiglottis on the left side was destroyed. In vocalization the right vocal cord was normally adducted, but on inspiration it remained about one-eighth of an inch from the median line. The action of the left vocal cord was perfect. The colour of both vocal cords was healthy. The voice was natural. The patient had suffered from syphilis ten years ago. Treatment of various kinds proved quite unavailing.

## BILATERAL PARALYSIS OF THE ADDUCTORS OF THE VOCAL CORDS.

(Synonyms: Functional Aphonia. Hysterical Aphonia. Aphonia. Nervous Aphonia.)

*Latin Eq.*—Paralysis bilateralis adductorum chordarum vocalium.

*French Eq.*—Paralysie bilatérale des adducteurs des cordes vocales.

*German Eq.*—Doppelseitige Lähmung der Glottisschliesser.

*Italian Eq.*—Paralisi bilaterale degli adduttori delle corde vocali.

Definition.—*Inaction of the adductors on both sides resulting in the non-approximation of the vocal cords on attempted phonation, and consequently giving rise to loss of voice.*

*Etiology.*—The most common cause of this affection is hysteria, and hence it is much more more common in women than men, and is more often met with among young women than old ones. Children rarely suffer from

this form of paralysis, but I have met with it at eight years and ten years of age—in both instances in girls. Professor Gerhardt[1] opposes the view that hysterical patients do not wish to speak aloud for fear of pain and inconvenience, on the grounds that, paralysis is not unfrequently more marked on one side than on the other, and that other symptoms of paralysis of the pneumogastric nerves may be often noticed. Among them he mentions the increased frequency of the pulse beats, unaccompanied by a corresponding rise in the temperature. He also thinks that some cases of so-called hysterical aphonia belong to the class of reflex paralyses. The affection is occasionally met with in chlorosis, but it far less commonly occurs in connection with amenorrhœa than might be supposed from the writings of some authors. More often it is the simply anæmic who suffer from it. It is common in the second and third stage of phthisis: and this is an important fact,[2] as the aphonia of phthisis is almost invariably attributed to the structural changes which are too frequently encountered in that disease. Silent people, whether their silence is voluntary or forced, are more subject to functional aphonia than those who are accustomed to use their tongues freely. Catarrh is also a cause of the affection. Thus a person "catches cold," the larynx is congested, and hoarseness or aphonia occurs. The congestion disappears, but the aphonia remains owing to the feeble approximative power of the vocal cords. This train of phenomena is often met with among public speakers—especially clergymen. Professor Gerhardt[3] considers these cases as examples of *catarrhal rheumatism*, and describes two other rheumatic forms of paralysis of the adductors, viz., *meta-rheumatic paralysis*, in which acute inflammation of the joints is followed by paralysis of the adductors; and *direct rheumatic paralysis* in which the affection is the result of exposure to draughts or taking cold drinks. Of the latter class of cases I have met with some examples; of the former none. Sometimes the muscular affection is the result of direct injury of the

[1] "Handb. d. Kinderkrankheiten," 2nd edition, p. 332.

[2] In 1865, in conjunction with Dr. W. H. Stone, I examined a number of cases at the Brompton Hospital. Thirty-seven cases of phthisis, in the second and third stage *in which the voice was affected*, were selected for laryngoscopic examination. In eleven of these the affection was purely functional; in twelve there was thickening of the mucous membrane; and in fourteen there was congestion.

[3] Virchow's Archiv, vol. xxi.

muscles on both sides, but injuries are more likely to be unilateral. Navratil [1] has described a remarkable case in which the lateral adductors were the subject of numerous calcified trichinæ; these parasites were much more numerous in the muscles of the left than in those on the right side, and whilst the former muscles were paralysed the latter were only in a state of paresis. Sometimes the affection is probably of a toxic character, *i.e.*, is due to the constitutional action of lead, arsenic, and perhaps other substances. As cases of *uni*lateral paralysis of the adductors of this nature have come under my notice, it is highly probable that the *bi*lateral affection may arise in the same way. Whether the rheumatic and the tonic forms are of a central or peripheral nature cannot at present be determined. It is remarkable that in the cases of toxic poisoning the *ad*ductors alone are affected, just as in lead poisoning the extensors of the forearm always suffer —the flexors never. The truly hysterical cases are not unfrequently associated with loss of power of articulation, the lips and tongue remaining perfectly immobile when the patient is directed to make an effort to speak.

*Symptoms.* — When a young woman, in comparatively good health, is suddenly taken with aphonia, the case almost invariably proves to be one of paralysis of the adductors. Sometimes the voice comes and goes, and this condition has been described as "intermittent aphonia," [2] but as it is generally merely a slighter degree of paralysis than when the affection is constant, and, as a rule, there is no regularity in the intermittence, it seems unnecessary, and even misleading, to use the term. It is characteristic of functional aphonia, that though the voluntary power of phonation is lost, the reflex function is not generally affected. The cough and the sneeze are usually accompanied with a distinctly laryngeal sound; the laugh, on the other hand, being a much feebler expiratory sound, and more under the control of volition, is not always phonetic. The laryngoscope, however, at once determines the nature of the case, for, on directing the patient to attempt to say, "*a*," the vocal cords are not closely approximated. They may approach one another slightly, or they may remain perfectly immobile, leaving a large triangular space between them. As already remarked it not unfrequently happens that though both vocal cords are paralysed, one is affected more than the

[1] "Berlin. Klin. Woch." 1876, No. 21.
[2] Levison: "Berlin. Klin. Wochensch." 1870, No. 46.

other. There is very often extreme anæmia of the laryngeal mucous membrane; but, on the other hand, in post-catarrhal cases *it may be congested*.

*Diagnosis.*—The only cases which are likely to be confounded with functional aphonia are those in which the loss of voice is due to feeble respiratory action—expiration not being powerful enough to set the cords in proper vibration. This source of fallacy has, however, only to be indicated to be avoided. It must further be borne in mind also that the approximative action of the cords may be interfered with by certain mechanical impediments, such as swelling of the inter-arytenoid fold, the presence of growths or cicatrices, and disease of the crico-arytenoid joints. The laryngoscope, however, generally enables the observer to detect these conditions.

*Pathology.*—As these cases never terminate fatally, post-mortem evidence as to the condition of the muscles could only be obtained through an accidental death occurring to a patient suffering from nervous aphonia. As yet no such case has been placed on record, and it is highly improbable that any structural changes would be discovered. The muscles are no doubt weak in most of these cases, and further, it would seem that the nerve-force is either feebly evolved, or not directed into the proper channel. The sudden restoration of the voice, which so frequently takes place, either spontaneously or as the result of treatment, can only be explained by some such theory as this. It may be mentioned, however, on the other hand, that Gerhardt[1] suggests that in some of the catarrhal cases there is probably some enlargement of the cervical glands, giving rise to pressure on the recurrent or pneumogastric nerves. The muscles which are paralysed are the adductors—the crico-arytenoidei laterales on each side, and the arytenoideus proprius, but the thyro-arytenoid muscles are, probably, also often simultaneously affected.

*Prognosis.*—The prognosis, as regards cure, is very favourable, for although these cases are often very obstinate, and resist a great deal and a great variety of treatment, they are almost always cured in the end. During the last twenty years I have treated several hundred such cases, and in very few instances without ultimate success. In several of these cases the aphonia was of six, seven, and eight years'

[1] "Handbuch der Kinderkrankheiten," 3ter Band. 2te Hälfte, p. 139.

standing; and in one, the voice was restored after having been lost for ten years.

*Treatment.*—Emotional influences often cure this form of aphonia, and we have an instance of the power of the mind in restoring the voice nearly two thousand five hundred years ago;[1] but remedies which stimulate the mucous membrane of the larynx, and thus, by reflex action, cause a mild spasm of the glottis, are those most rational in principle, and most successful in practice. These stimulating remedies may be applied in the form of inhalations, sprays, or pigments, or endo-laryngeal faradism may be employed. I have several times known a vapour impregnated with ammonia restore the voice. The inhalation of chlorine has also been successfully used by Professor Pancoast,[2] of Philadelphia, but the stimulating inhalations of the Throat Hospital Pharmacopœia will be found more manageable and not less efficacious. Of these the Calamus Aromaticus and Creasote Inhalations are the most active. Stimulating, or strongly astringent solutions, such as nitrate of silver (ʒj. ad ℥j.), or perchloride of iron (ʒij. ad ℥j.) may be applied with a brush to the interior of the larynx; or these remedies can be introduced into the larynx in the atomized form. But whilst both the inhalations and local applications often fail, endo-laryngeal faradism is almost always successful. Electricity applied through the neck sometimes restores the voice, but when it has been lost for any length of time the percutaneous method cannot be relied on.

In using the laryngeal electrode, one pole is passed within

[1] Herodotus remarks (book i. Clio, chap. 85), "We have now to speak of the fate of Crœsus. He had a son, as I have before related, who, though accomplished in other respects, was unfortunately dumb. Crœsus, in his former days of good fortune, had made every attempt to obtain a cure for this infirmity. Amongst other things, he sent to inquire of the Delphic Oracle. The Pythian returned this answer:—

> 'Wide ruling Lydian, in thy wishes wild.
> Ask not to hear the accents of thy child;
> Far better were his silence for thy peace,
> And sad will be the day when that shall cease.'

"During the storming of the city, a Persian meeting Crœsus, was, through ignorance of his person, about to kill him. The king overwhelmed by his calamity, took no care to avoid the blow or escape death; but his dumb son" (ὁ δὲ παῖς οὗτος ὁ ἄφωνος, is the expression), "overcome with astonishment and terror, exclaimed aloud" (literally, broke his voice, ἔρρηξε φωνήν), "'Oh, man, do not kill Crœsus!' This was the first time he had ever spoken (ἐφθέγξατο), but he retained the faculty of speech (ἐφώνεε) from this event as long as he lived."

[2] Wood's "Practice of Medicine," vol. i. p. 834.

the glottis and placed on the vocal cords, and the other applied externally by means of a necklet (see page 252). The laryngeal rheophore should be kept in contact for a second or two and then withdrawn. The current may be applied five or six times at a sitting. It will generally be found that a distinctly laryngeal sound can be produced on the first application of endo-laryngeal faradism, and that the voice will get stronger on each succeeding application. Should any hyperæmia of the mucous membrane be present it is very important not to apply the electric current until the congestion has been got rid of. I have seen many cases in which, from non-attention to this precaution, practitioners have been disappointed in the results of internal faradism.

Instead of these local remedies, however, more general measures may be employed. Thus where the aphonia is dependent on hysteria, the ordinary anti-hysterical treatment, especially the use of the cold shower-bath, is sometimes successful. The inhalation of chloroform also frequently effects a cure. The patient should be rendered quite insensible, and then, as consciousness is returning, should be engaged in conversation. In this way the patient is, as it were, trapped into speaking aloud, and the voice often remains when the influence of the chloroform has passed away. This treatment is, however, very uncertain, when compared with the endo-laryngeal application of electricity, and only answers in the purely hysterical cases.

In most cases when the voice has once been restored, it is important to adopt measures to keep up the effect. The external application of faradism employed daily, or every other day, for a week or two, is often of great service for this purpose. The patient should also be directed to exercise the voice regularly, by counting and reading aloud—gradually increasing the exercises, both as regards their duration and the loudness of voice. For keeping up the action of the muscles "laryngeal gymnastics," first recommended by Dr. H. K. Olliver,[1] of Boston, are often useful. These consist in gentle but firm manipulations of the larynx externally: the adductors may be assisted by compressing the alæ of the thyroid cartilage in their upper and posterior part between the finger and thumb whilst an attempt is made to emit a sound. To bring the external tensors into play, the operator should stand behind the patient, and, fixing the thyroid cartilage with his thumbs, should raise the cricoid with his

[1] "American Journ. Med. Sci." April, 1870, p. 305.

middle fingers at the very moment when the patient tries to produce a sound. Dr. Oliver has even found this method sufficient for restoring the voice without the previous use of electricity. Functional aphonia is so common and so easily cured by endo-laryngeal faradism, that I do not think it necessary to append any illustrative cases.

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### Paralysis of One Lateral Adductor.[1]

Definition.—*Inaction of the adductor on one side, causing the affected vocal cord to remain at the side of the larynx on attempted phonation, and giving rise to a hoarse and shrill voice.*

*Etiology.*—The condition may be due to chronic toxæmia (lead, arsenic), or may be caused by cold or muscular strain. I have met with it after small-pox and as a result of syphilis.

*Symptoms.*—The condition can be detected with the laryngoscope. On attempted phonation, the affected vocal cord remains at the side of the larynx, so that it is scarcely visible, whilst the healthy one is well adducted to the median line. The mucous membrane covering the affected vocal cord may be normal, but is often congested. There is aphonia or dysphonia, and usually an absence of constitutional symptoms. When the paralysis of the adductors on one side is complete, or even well-marked, the acts of coughing, sneezing, and laughing are always altered in character, and often unaccompanied by sound; indeed, a modification of the natural cough or sneeze is often one of the earliest symptoms. The affection is not unfrequently associated with slight dysphagia.

*Pathology.*—As regards the pathological anatomy, I may observe that in the only case of this disease, which I have examined after death—a case of seven years' standing—there was considerable atrophy of the adductor (crico-arytenoideus lateralis) on the affected side. The arytenoideus proprius did not appear to have suffered.

*Diagnosis.*—The most likely source of error in examining a case of this sort, is to be found in swelling of a ventricular band, which in this condition more or less eclipses the true cord on the same side. It thus happens that when the larynx is examined, one vocal cord is seen

[1] See Foot-note, page 462.

to be adducted well to the median line, whilst the other is not visible at all. A little practice with the laryngoscope will enable the observer to recognize the true nature of the case. Symptoms of a paralytic character are sometimes produced by destruction or impairment of one of the crico-arytenoid joints from ossification or other morbid changes. In these cases there is generally some abnormal appearance, such as enlargement or swelling about the base of the arytenoid cartilage.

*Prognosis.*—The condition not being in itself dangerous, and being generally due to local causes, need not, as a rule, give rise to serious apprehensions. Only those cases which are due to chronic toxæmia, or to catarrhal or syphilitic inflammation, are amenable to treatment.

*Treatment.*—Some patients recover spontaneously, or by the use of warm inhalations, and where the disease is due to chronic toxæmia, the application of electricity to the laryngeal muscles often does good in recent cases. The electricity should be applied with the double electrode, which should be made to ride straddlewise over the ary-epiglottic fold, just in front of the cartilages of Wrisberg. Where, however, the aphonia has been of many years' standing before a laryngoscopic examination has been made, treatment is of little use. For here it is not as in bilateral paralysis, where the reflex action of the muscles not being interfered with, the integrity of the muscular structure is maintained.

## CASES ILLUSTRATING PARALYSIS OF ONE LATERAL ADDUCTOR.

Mr. G., a well-known surgeon, practising in Bloomsbury, consulted me in 1864 on account of aphonia of several years' duration, which came on with an attack of diphtheritic paralysis some years previously. The aphonia was due to paralysis of the adductor of the right vocal cord. Neither galvanism nor faradism had any effect in this case, and the adductor remained permanently paralysed. The action of the abductor was perfect.

The daughter of a practitioner at Anerley was brought to me in 1865, suffering from paralysis of the adductor of the left vocal cord. The cause of the paralysis was the same, and the result of treatment as negative as in the last case.

Charles E., aged forty-nine, applied at the Throat Hospital, February 3rd, 1867, on account of loss of voice and shortness of breath. Laryngoscopic examination showed paralysis of the adductor of the left vocal cord, which only came into view on placing the laryngeal mirror very obliquely. The patient had a temperature of 103°, and his pulse was 138, and on examining the chest, the cause was found in extensive pleurisy of the right lung. He died ten days later, and at the post-mortem examination the lower half of the right lung was

found to be hepatised, whilst the pleural cavity contained about two ounces of purulent fluid. The recurrent and pneumogastric nerves were carefully dissected, and portions submitted to microscopical examination, and they everywhere appeared healthy. The left crico-arytenoideus muscle and the fibres of the thyro-arytenoid muscles were greatly atrophied—indeed of the former there was scarcely any muscular tissue remaining. The other muscles on both sides were quite healthy. There were several deep scars, probably syphilitic, on the posterior wall of the pharynx, at the lower part, but neither scar nor contraction could be seen in the larynx. The patient's wife said that he had not spoken out loud for seven years, and that at the time he had first lost his voice he had suffered from a bad sore-throat, which prevented his swallowing. The cause of the muscular atrophy was probably a gummatous deposit.

M. S., aged twenty-three, consulted me in March, 1874, on account of hoarseness of one month's duration. A laryngoscopic examination showed great congestion of the mucous membrane of the larynx, and paralysis of the adductor of the right vocal cord. Under the use of soothing inhalations the congestion disappeared at the end of a fortnight, but the right vocal cord remained absolutely immovable on attempted phonation. The abductive action, on the other hand, was perfect; six weeks later, under the continued use of faradism, the adductor recovered its power and the voice was restored.

In another case which came under my notice at the Hospital for Diseases of the Throat in December, 1875, the patient was a painter, aged thirty-five, and the adductor of the right vocal cord was completely paralysed, apparently as the result of lead poisoning. The disease was of five months' standing, and a cure was effected in two months by the endo-laryngeal application of electricity and the internal administration of bark and iodide of potassium.

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## Paralysis of the Central Adductor

## (inter-arytenoid muscle).

This muscle is frequently affected in conjunction with the lateral adductors, and occasionally suffers alone. Its action is most often impaired through catarrh, but sometimes hysteria is the cause of the loss of power.

Loss of voice is the *symptom* of this affection; and on laryngoscopic examination, whilst the vocal cords are seen to approximate well in the anterior three-fourths of the glottis, the posterior, or cartilaginous portion of the glottis remains open, leaving a triangular space between the cords in this situation.

The *prognosis* in recent cases is favourable, but a case described below has been under observation for twelve years, and is very much in the same state as it was when first seen.

The *treatment* should consist, in catarrhal cases, of stimulating inhalations and astringent applications; but in those of longer standing faradism applied to the inter-arytenoid fold will generally be found necessary.

FIG. 97.

E. H., a spinster, aged thirty-seven, came under my care at the Throat Hospital in August, 1867, on account of loss of voice of two years' duration. The patient was sent to me by Dr. Hall, of Brighton, who had treated her some years previously for a uterine affection. She was very weak, but was free from organic disease. On laryngoscopic examination the vocal cords were seen, on vocalization, to approximate properly in the anterior three-fourths of the glottis, but to remain widely separate in the posterior fourth, leaving a triangular opening. Constitutional remedies of a tonic and anti-hysteric character were used, and endo-laryngeal faradism employed. But all to no purpose. The strongest electrical shocks could not elicit the faintest sound. The patient was placed under chloroform, but on restoration to consciousness could never be made to utter a sound. This case has been under observation for the last twelve years, but it has never been possible to restore the voice.

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## PARALYSIS OF THE EXTERNAL TENSORS OF THE VOCAL CORDS (CRICO-THYROID MUSCLES).

This affection may be either bilateral or unilateral, but both forms are rare. It most commonly arises from exposure to draughts of cold air on the neck, but it also occasionally results from a too violent or a too prolonged use of the voice, especially when the vocal function is exercised out of doors. In these cases the voice is sometimes only very gruff, but more often it is altogether suppressed. Occasionally, on placing the finger over the crico-thyroid muscles in the neck, and directing the patient to attempt to produce a vocal sound, the non-contraction of the muscle may be perceived. The laryngoscopic appearance has been described at page 435.

The prognosis is favourable, and rest alone often effects a cure. Percutaneous faradism is, however, indicated, and, in

many cases, blistering, or even a wet compress round the neck, will hasten the restoration of function.

## CASES ILLUSTRATING PARALYSIS OF THE EXTERNAL TENSORS.

*Case* 1.—A military man, aged thirty-nine, became voiceless after exerting himself by giving the word of command. On laryngoscopic examination, the characteristic wavy outline of the free edge of the vocal cords was very distinct (see Fig. 88). The voice was at first quite lost, but on the second day assumed a thick muffled tone, in which state it had continued for nearly two months. This case was quickly cured by means of a blister applied across the neck over the crico-thyroid space.

*Case* 2.—L. N., aged fifty-one, consulted me in June, 1876, on account of loss of voice which had existed for two years. On making a local examination the vocal cords were seen to be normal in colour, to be well adducted to the median line, but to show undoubted signs of relaxation. The glottis, when the vocal cords were approximated, exhibiting a waved outline which constantly varied. On examining the neck I observed a transverse scar across the neck, commencing from a spot in a line with the ear on the right side, to a spot in a line with the angle of the jaw on the left side, and passing in the front between the thyroid and cricoid cartilages. The patient admitted that two years previously he had attempted to commit suicide, and that for some months afterwards he had been troubled with a fistulous opening in the windpipe in the centre of the throat; he stated that the wound had been very deep in its whole course, and there had been considerable hæmorrhage. It was clear from the examination of the wound that the lower attachment of the crico-thyroid on each side had been completely severed. I did not think it of any use attempting any further treatment in this case.

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## PARALYSIS OF THE INTERNAL TENSORS OF THE VOCAL CORDS (THYRO-ARYTENOIDEI INTERNI).

Cases frequently occur in which, on attempted phonation, the vocal cords remain slightly separated in the middle third

FIG. 98.

of the glottis, and it is generally thought that this condition is due to paralysis of the internal tensors. It is not improbable, however, that in some of these cases a few fibres

of the lateral crico-arytenoid muscle may be the real parts at fault. This form of paralysis is frequently met with among singers, and is due to over-fatigue of the voice. Sometimes it probably results from an actual sprain of the muscle occurring as the result of some undue effort in vocalization. In the former case, rest for a few days and soothing inhalations are generally sufficient to effect a cure; in the latter, the affection can often be only overcome by rest of many months' duration, and it is often incurable. Endo-laryngeal galvanism is useful in cases resulting from over-fatigue and following catarrh, whilst faradism is more beneficial in those which are of an hysterical character.

*Paralysis of the Thyro-Arytenoid Muscles of Three Years' Standing Cured by Endo-laryngeal Faradism.*—A young lady, aged twenty-six, of delicate appearance, but not at all hysterical, was sent to me by Mr. Tapson, in 1863, suffering from aphonia of three years' standing. The loss of voice commenced with an ulcerated sore throat, but when the ulcer healed her "voice did not return," and she continued, during the whole of the time previous to coming under my observation, unable to speak above a whisper. She had undergone a considerable amount of treatment by caustic applications and external galvanism, combined with the administration of anti-neurotics. On making a laryngoscopic examination, the cords were seen to be very pale and narrow. On attempted phonation they approximated well, but were still distinctly relaxed, whilst an upward bulging towards their centres was quite perceptible. Under the use of electricity, applied to the vocal cords by means of my laryngeal electrode, her voice was restored in about three weeks.

[Though I formerly reported [1] this case as one of paralysis of the crico-thyroid muscles, the fact that the affection rapidly yielded to laryngeal faradism, whilst it had resisted percutaneous electricity, strongly points to the conclusion that the internal adductors were mainly affected.]

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## Mixed Paralyses.

It will be easily understood that paralyses do not always occur in the simple forms which have been described in the foregoing articles, and that the shape of the glottis will vary according to the combination of muscles paralysed. As a rule, the lateral adductors and central adductor are affected together, and in that case the glottis represents a triangular opening. Sometimes, however, the internal tensors are affected, together with the central adductor (arytenoideus proprius), whilst the lateral adductors are only slightly

[1] "Hoarseness and Loss of Voice," &c. Second Edition, p. 46.

affected; an image is then presented which combines the features of the double paralysis. The laryngoscopic appearances are, under the circumstances, made up of Fig. 97 and Fig. 98. Although in these figures the paralysis is portrayed as bilateral, the reader will readily appreciate the modification of form which takes place when only one side of the larynx is affected.

Not only do the combinations of paralyses vary immensely, but spasm of some muscle may occur at the same time as paralysis of others. Hence it can be readily conceived that the resulting laryngoscopic image may undergo great complications, and that the permutations of which it is capable are often difficult, and sometimes impossible, to decompose.[1]

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## Atrophy of the Vocal Cords.

Atrophy of the vocal cords is extremely rare, and, as far as I am aware, has not been proved to exist by post-mortem evidence. I have, however, reported four cases[2] in which there was every appearance of atrophy during life. The rarity of the affection is probably due to the exceedingly dense structure of the vocal cords and the slowness with which the nutritive changes take place in the normal condition. When there is wasting the cords may have merely a shrunken appearance, or they may be so withered, that, although there is no obstruction to inspection, they cannot be brought into view. Besides my own cases, Ziemssen[3] has given an illustration of this affection, but he remarks that a case came under his notice in which pressure on the recurrent nerve existed for seventeen years without causing any atrophy of the corresponding vocal cord.

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## Anchylosis of the Arytenoid Articulations.[4]

Notwithstanding the exposed position of the crico-arytenoid articulation, fixature of the joint must be rare,

[1] Koch: loc. cit.

[2] "Hoarseness and Loss of Voice," p. 71.

[3] "Cyclopædia," vol. vii. p. 955.

[4] This article would have been more appropriately inserted after "Perichondritis," but having been accidentally omitted in its proper place, I have thought it better to insert it here, affections of the joint being so likely to be mistaken for muscular paralyses.

for immobility of the vocal cords is not a very common condition, and where it does exist it is often due either to nervo-muscular affections, or to general tumefaction of the soft parts, which mechanically prevents the movements of the cords. That it does occasionally occur, however, there is little doubt. This subject has not been hitherto treated with any detail, although the condition has been incidentally referred to by Türck,[1] Sidlo,[2] Ziemssen,[3] Mandl,[4] Schrötter[5], Koch,[6] Burow, jun.,[7] Semon,[8] and myself.[9] Anchylosis of the crico-arytenoid joint may arise from perichondritis or chondritis, either of which may occur primarily or result from extension of disease from the superjacent soft parts. It is probable also that it may be due to primary synovitis, either rheumatic, gouty, or simply catarrhal, and in some cases it most likely arises from mere disuse, brought about either through the muscles having been previously paralysed, or through changes in the contiguous parts preventing the movement of the joint for a long period, and thus giving rise to permanent anchylosis. Or the fixature may be due to traumatic injuries, such as wounds, contusions, or dislocations. Perichondritis, generally due to typhoid fever or syphilis, is undoubtedly the most common cause of the affection; for, according to Dr. Semon, out of ten cases on record in five instances the disease was due to inflammation of the perichondrium covering the cricoid or arytenoid cartilages. The symptoms vary according as the disease is unilateral or bilateral, according to the degree of mobility of the joint, and according to the position in which the arytenoid is fixed on the cricoid cartilage. Thus, if the arytenoid be fixed on the outer part of the cartilage we have the vocal

[1] "Klinik der Krankheiten des Kehlkopfs," etc. Wien, 1866, p. 214.

[2] Ziemssen's "Cyclopædia," vol. vii. p. 968.

[3] "Cyclopædia," vol. iii. p. 821. English edition.

[4] "Gazette des Hôpitaux," Nro. 20. 63. 1862.

[5] "Beitrag zur Behandlung der Larynxstenosen," Wien, 1876; and "Jahresberichte der Klinik für Laryngoscopie," Wien, 1871 and 1875.

[6] "Annales des Maladies de l'Oreille," etc. 1877, Nov. 6, p. 335, and 1878, Nov. 2, p. 13.

[7] "Laryngoscopischer Atlas." Stuttgart, bei Enke, 1877, p. 66.

[8] "Trans. Clin. Soc." vol. xi. 1878, p. 149; and "Med. Record," Jan. 1879, No. 84. p. 21. My colleague, Dr. Semon, is also preparing an exhaustive article on the subject of anchylosis of the arytenoid articulations, and he has kindly permitted me to peruse his manuscript.

[9] "Hoarseness, Loss of Voice, and Stridulous Breathing." London, 1868, p. 6 and p. 18.

cord permanently drawn aside, and permanent dysphonia, whilst if the arytenoid cartilage is fixed near the centre of the cartilage, the vocal cord is permanently fixed near the median line, and there is persistent dyspnœa.

The diagnosis of the condition is attended with some difficulty, and paralysis of either of the adductors or the abductors may simulate anchylosis; the affection may, however, be inferred to exist when immobility of one or possibly of both the vocal cords is accompanied by some marked irregularity in the form of the cartilages, or the upper part of the cricoid cartilage. It should be also specially looked for in the case of patients who are convalescent from typhoid fever, and have some alteration in voice, or difficulty in breathing. I am not aware that any treatment would be likely to give very satisfactory results; but if the arytenoid cartilages are fixed in a central position forcible dilatation should be effected according to the mechanical methods laid down in the last article, after tracheotomy has been performed; and this treatment should, if possible, be employed *prophylactically* in cases of perichondritis after typhoid fever and syphilis, in which considerable destruction of the joint has taken place, and subsequent anchylosis is to be feared.

## SPASM OF THE GLOTTIS.[1]

(Synonyms: Spasm of the Adductors of the Vocal Cords. Spasmodic Croup. Cerebral Croup. Millar's Asthma. Child-crowing.)

*Latin Eq.*—Spasmus glottidis. Laryngismus stridulus. Asthma Millari. A. Koppii. A. intermittens infantum. Angina spastica. Clangor infantum.

*French Eq.*—Spasme de la glotte. Pseudo-croup. Croup nerveux.

*German Eq.*—Krampf der Glottis. Stimmritzenkrampf.

*Italian Eq.*—Spasmo de la glottide.

Definition.—*A form of convulsions occurring in ill-nourished (usually rickety) infants, characterized by spasmodic action of the adductors of the vocal cords, and, in severe cases, by spasm of the diaphragm and intercostal*

[1] It is important to bear in mind that spasm of the glottis is not in itself a disease, but merely the symptom or local expression of disease existing elsewhere.

*muscles. The most marked symptom of the disease is a succession of short, stridulous inspirations, which gradually become more prolonged, and generally culminate in a fit of ordinary crying, though sometimes they result in complete cessation of respiration and death.*

*History.*—This disease has presumably existed from time immemorial, for the conditions which give rise to it have probably always been in operation. In the earliest medical records we find it described under the name of "the asthma of children," and Hippocrates,[1] in referring to it under this head, mentions that it occurs soon after the first teeth begin to appear. Two or three hundred years later, Galen,[2] with greater precision but less accuracy, stated that the age at which the disease is most frequently met with is from the time of the cutting of the first teeth to the twelfth or thirteenth year. The references to the affection by Aretæus, Paulus Ægineta, and Celius Aurelianus are very vague, and it was not until the end of the seventeenth century that the disease was described with any degree of accuracy. In the year 1697, however, Etmuller,[3] gave an account of the "suffocative convulsions of infants," which he thought might arise either from spasm of the closers or paralysis of the openers of the glottis.[4] In the year 1761 Dr. James Simpson[5] published a short essay which may be regarded as the starting-point of the modern views regarding the disease; and, a few years later, Dr. John Millar[6] published an important work, in which Simpson's observations, previously but little known, were considerably elaborated. Millar appears to have met with cases of catarrhal laryngitis, and possibly with cases of laryngeal diphtheria, but he also no doubt had observed examples of true laryngismus. In his "first and second stages" of laryngismus, he did not clearly discriminate between these three affections, and hence it is not remarkable that his views, both as regards the etiology and treatment of the disease, are somewhat confused. Underwood[7] gave a tolerably clear account of the disease in 1789, and Wichman,[8] of Hanover, appears to have accurately portrayed it about the year 1795. The affection was subsequently described with considerable detail by Burns,[9] Hamilton,[10] Clarke,[11] and other writers on the diseases of women and children. After this for a time the complaint attracted little attention, and it was not until Kopp[12] published his celebrated work, in which he attributed the affection to enlargement of the thymus gland, that we again find any activity of research in connection with the subject. Kopp's treatise called forth a number of articles in Germany, and soon afterwards a most scholarly work was published in this country by Dr. Ley.[13] This classical production

[1] "Aphorism." sect. 3, aph. 26.
[2] "Obs." lib. 1, p. 184.
[3] "Op. om." 1697, vol. ii. p. 273, et seq.
[4] Ibid, p. 283.
[5] "Dissertatio Inaug. de Asthmate Infantum Spasmodico." Edin. 1761.
[6] "Observations on the Asthma and the Whooping Cough." 1769.
[7] "Diseases of Children." Second Edition.
[8] This work is referred to by Steffen and Flesch, but the best account of its contents is found in Hugh Ley's work. I have not been able to find a copy of the original article.
[9] "Principles of Midwifery." 1809.
[10] "Diseases of Infants and Children." Seventh Edition, 1813.
[11] "Commentaries on Important Diseases of Children." 1815.
[12] "Denkwürdigkeiten in der ärztlichen Praxis." Frankfort, 1830.
[13] "Essay on Laryngismus Stridulus." London, 1836. I am indebted to this work for much of my knowledge of the history of the disease.

contains an admirable account of the pathology of the nerves, as far as it was known at that period, but its clinical value is diminished by the peculiar views of the author as to the etiology of the disease. Dr. Ley considered that laryngismus is always due to *paralysis* of the abductors arising from pressure of strumous, bronchial, or cervical glands on the recurrent or pneumogastric nerves. In 1841 Dr. Marshall Hall,[1] in a work which revolutionized the previously-existing views as regards the physiology and pathology of the nervous system, referred laryngismus in all cases to reflex causes. In 1843 Elsässer[2] published a book in which he attributed laryngismus to softening of the occipital bones and the consequent pressure to which the brain is subjected when the child lies on its back; and though this theory of causation has since been shown to be incorrect, the work was of great value in drawing attention to the frequent association of the rachitic condition and laryngismus. In 1847 an able essay (the first important treatise on the subject that had issued from the French school) was written by Herard.[3] Two years later the interesting work of Dr. James Reid[4] appeared, and in 1858 Dr. Friedleben[5] for ever disposed of the thymic theory by showing that, even when greatly enlarged, the gland never presses on the recurrent nerves or trachea.[6] In 1867 Professor Henoch[7] published an important lecture on the subject, and in the following year Löschner[8] described the immediate conditions leading to an attack of laryngismus with marked ability. The subject of laryngismus has lately been treated in a very complete manner by Steffen[9] and Flesch.[10] In the above short historical *résumé*, it has been impossible to do justice to nearly all the authors who have written on the subject, but the names of Lorent, Salathé, Meigs, Lederer, Hauner, West, Fleischmann, and Gerhardt, must not be altogether omitted.

*Etiology.*—Spasm of the glottis is comparatively rare, having been observed only 297 times among 112,657 sick children at the Great Ormond Street Hospital. The causes of the affection are involved in considerable obscurity, and the etiological views concerning it have from time to time undergone much change. The development of the disease may, however, be conveniently considered in relation to predisposing and exciting influences. Among the former are age, sex, social condition, season of year, physical organization, and heredity. Amongst the exciting causes must be reckoned anything which teases the child or directly irritates the larynx.

[1] "The Nervous System," &c. 1841.
[2] "Der weiche Hinterkopf." Stuttgart, 1843.
[3] "Du Spasme de la Glotte"—"Thèse de Paris," 1847.
[4] "On Infantile Laryngismus." London, 1849.
[5] "Die Physiologie der Thymusdrüse in Gesundheit und Krankheit," etc. Frankfort, 1858.
[6] Notwithstanding the conclusive character of Dr. Friedleben's work, the thymic fallacy has again been revived by Dr. Abelin ("Meddelanden från Pediatrika Kliniken å Allmänna." Barnhusdt i Stockholm for Ar. 1868).
[7] "Berlin. Klin. Wochenschrift," 1867, No. 19.
[8] "Aus dem F. J. Kinderspitale in Prag." Prag, 1868, p. 144.
[9] "Ziemssen's Cyclop." vol. vii.
[10] "Gerhardt's Handbuch," &c., 3ter Bd. 2te Hälfte

*Age* is undoubtedly the most influential predisponent to the disease. Not only is the nervous system, when undergoing the rapid developmental changes of infancy, very prone to take on morbid action; but the small size of the glottis, and the yielding character of the tissues of the larynx in the young, cause very slight changes to give rise to marked symptoms. Flesch[1] considers that the disease is very rare after the twenty-first month, and Steffen[2] remarks that by far the majority of cases occur between the age of four months and the completion of the second year. In my own 31 cases the ages at which the attacks occurred were as follows:—From birth 1 case, at 4 months 1 case, at 5 months 6 cases, at 6 months 5 cases, at 7 months 7 cases, at 9 months 3 cases, at 10 months 1 case, at 11 months 2 cases, at 15 months 3 cases, at 17 months 1 case, and at 23 months 1 case. Dr. Gee[3] found in 48 cases, 1 at six months, 19 from 6 to 12 months, 16 from 12 to 18 months, and 12 from 18 months to 3 years. In 31 out of 37 cases seen by West,[4] the affection occurred between the age of six months and 2 years. The following tables compiled from the Registrar-General's Reports, showing the number of deaths, for the twenty years 1857 to 1876 inclusive, from the disease occurring at different ages, afford still more conclusive evidence as to the importance of age as a predisponent.

ANALYSIS OF THE REGISTRAR-GENERAL'S REPORTS ON THE MORTALITY FROM LARYNGISMUS.

*Children under* 10 *Years of Age.*

| | Totals. | Under 1 year. | Years of age. 1 | 2 | 3 | 4 | From 5 to 10 years. |
|---|---|---|---|---|---|---|---|
| Females .. .. .. | 2547 | 1487 | 691 | 152 | 94 | 60 | 63 |
| Males .. .. .. | 4771 | 2915 | 1395 | 213 | 97 | 63 | 88 |
| Grand Total .. | 7318 | 4402 | 2086 | 365 | 191 | 123 | 151 |

*Adults.*

| | Totals. | Years of age. 10 | 15 | 20 | 25 | 35 | 45 | 55 | 65 | 75 |
|---|---|---|---|---|---|---|---|---|---|---|
| Females .. .. .. | 13 | 5 | — | 1 | 2 | 2 | 1 | 1 | 1 | — |
| Males .. .. .. | 24 | 7 | 1 | 2 | 2 | 2 | 3 | — | 4 | 3 |
| Grand Total .. | 37 | 12 | 1 | 3 | 4 | 4 | 4 | 1 | 5 | 3 |

[1] Loc. cit. [2] Loc. cit.
[3] "St. Barthol. Hosp. Reports," vol. iii. p. 104.
[4] "Diseases of Infancy and Childhood." Sixth Edition, p. 190.

The influence of *sex* is the same as in most laryngeal diseases, boys being much more frequently affected than girls. Steffen has collected from different authors 554 cases, of which 386 occurred in male children, and 168 in females. Of 297 cases seen at the Hospital for Sick Children, 166 were males and 131 females; whilst of fatal cases appearing in the Registrar-General's Returns 4,771 were boys and 2,547 girls. In Gee's 48 cases, 34 were males and 14 females, whilst of my 31 patients 21 were boys and 10 girls.

*Social condition* has a decided influence, the children of poor parents being more liable to the disease than those of the well-to-do, for reasons which will be explained under head of "Physical Organization." The influence of *season* is considerable. It has been shown by Henoch, and by Barthez and Rilliet, that the disease is much more common in the earlier than in the later months of the year, and these observations have been confirmed in a remarkable way by Dr. Gee,[1] who out of 63 cases observed 58 in the first six months of the year, and only 5 in the last six months. The following summary shows the number of Dr. Gee's cases occurring in each month :—January 3, February 11, March 7, April 13, May 16, June 8 (total 58), August 1, September 0, October 1, November 1, December 2 (total 5). Of my 31 cases 19 occurred in the first, and 12 in the last six months of the year. The greater predisposition to the disease in the late winter and early spring months is attributed by Dr. Gee to the exalted nervous condition of the children, induced by their being kept indoors during these months, and this ingenious explanation is independently advanced by Flesch.

The *physical organization* of the child is probably the most influential factor in the production of the disease. Children who are ill-nourished, and live in badly-ventilated rooms, are above all others most subject to the complaint. Amongst the upper classes, hand-fed children are most frequently attacked, whilst amongst the poor the affection is most common where the mother is in bad health, or continues to suckle for a long time. The disease, as was first pointed out by Miller,[2] often comes on at the time of weaning, an occurrence caused by the use of farinaceous food which the child is unable to digest. In a very large proportion of cases the children who suffer from laryngismus are rickety. Flesch[3] says that in three-fourths

[1] Op. cit. vol. xi. p. 47.
[2] Op. cit. [3] Loc. cit.

of the cases rickets is present. Gee[1] found rickets in 48 cases out of 50 occurring amongst the poor, and in my own 31 cases —all of which occurred in private practice—the rachitic condition was present to a slight extent in 17 cases, whilst in 2 cases it was very marked. It does not follow that rickets is to be regarded as a cause of laryngismus, although this view has been advocated and will be again referred to (see "Pathology"), but there is no doubt that the two conditions very frequently co-exist.

As regards *heredity*, I am not aware that there are any cases which actually prove the descent of the disease from parent to child, but my cases, which are here reported, strongly point to consanguineous influence. The cases reported by Gerhardt[2] in which laryngismus proved fatal to seven children out of a family of nine, and the cases related by Reid,[3] in which, out of a family of thirteen, ten died of the disease and only one escaped an attack, may all be explained on the supposition that in each instance all the children were exposed to the same anti-hygienic conditions.

A gentleman of slightly strumous organization married a healthy woman, and had two boys and two girls. They none of them suffered from laryngismus, but the influence of the father's constitution was shown in the children by enlarged cervical glands, hypertrophied tonsils, and early decay of the teeth. The family grew up; all married, and all had children. In two of the families one child had laryngismus, in one family two children suffered from the disease, and in one family three children were affected. In all four families the children were slightly rickety.

The exciting causes of laryngismus, as stated above, are to be found in anything which teases the child, and more particularly in such conditions as irritate the throat or larynx. Thus crying will often bring on an attack. This is very intelligible when we remember that in crying or sobbing, the inspirations are always short and jerky, and indeed allied in their character to those of laryngismus. Again, a fit may often come on during sucking, either from a little milk getting into the larynx, or from the altered condition of respiration owing to the child breathing entirely through the nose. It is, however, possible that the attack in these cases is due to the irritating character of the food when it comes in contact with the lining membrane of the

[1] Op. cit. vol. iii. p. 103.
[2] "Lehrbuch der Kinderkrankheiten." 1871, p. 285.
[3] "Lancet," May 1, 1847.

stomach. Dandling the child in the arms, again, often brings on an attack. This is probably owing to the sudden descent through the air, for we notice that adults in a rough sea, when the vessel descends into the trough of the waves, have a disposition to take a short inspiration and then hold the breath. The same sensation is also often experienced, and met in a similar manner, in swinging during the process of descent. In health during sleep the state of the brain is probably that of comparative anæmia, and the respiratory function is more feeble than at other times; hence if the brain is abnormally anæmic (or otherwise the subject of molecular deterioration), or if the respiratory function is in an unstable condition, it is obvious that the sleeping state may bring on an attack of glottic spasm; but whether sleep exercises its unfavourable influence through the nerve-centre, which specially presides over the general function of respiration, or through that which controls the laryngeal muscles, cannot be determined. The possibility, moreover, of an attack being induced by a little saliva passing into the larynx, or by mucus drying on the surface of that organ, must not be ignored. An accidental catarrh is also extremely likely to promote an attack, whilst of the more distant sources of irritation indigestible food is the most common, though diarrhœa and worms are in rare cases immediate causes of the disorder. Difficult dentition also occasionally acts as an exciting cause, but the influence of this condition in laryngismus has been enormously over-rated.

*Symptoms.*—The first attack of laryngismus often comes on at night—frequently towards eleven or twelve o'clock, when the first deep sleep is passing off. It may occur to a child who up to that moment had seemed perfectly well, but more often the subject of the attack has been peevish and fretful for a few days before, has suffered from loss of appetite and been restless at night, or a slight "catch" has been noticed in its breathing. A severe fit of laryngismus may thus be described:—A number of short stridulous inspirations take place, each inspiration being a little longer than the preceding one, and the last being often very prolonged. Suddenly the sound ceases, the glottis is completely closed, and the respiratory movements of the chest are suspended. The flush which first suffused the countenance gives way to pallor and afterwards to lividity. The eyes stare, or the eyeballs roll, the head is thrown back and the spine is often bent as in opisthotonos; the veins of the neck are turgid, the

fingers close on the thumb, which is bent in the palm, and the hands are flexed on the wrist. Spasm likewise affects the feet; the great toe is drawn away from its fellows, the foot is flexed and rotated slightly outwards. In some cases these so-called "carpo-pedal" contractions are probably accompanied with great pain, and occasionally they are followed by general convulsions. Notwithstanding the severity of the paroxysm just described, it is not necessarily fatal; the patient may survive it, in which case the diaphragm soon relaxes, a stridulous inspiration is heard, air enters the lungs, and the spasmodic contraction of the feet and hands gradually yields. But when the symptoms are of the dangerous character just described, the paroxysm is probably destined to be quickly followed by others, in one of which the child may die. In less severe cases all the symptoms are less marked, and the carpo-pedal contractions are often altogether absent. The attack frequently comes on whilst the child is at the breast. The infant suddenly stops sucking and looks round, its eyeballs are turned up, and after a second or two a loud crow is heard; the infant then returns to the breast or the bottle, but only to be seized immediately afterwards with a similar paroxysm. Sometimes each attempt to suck brings on such an alarming attack of spasm, that the unhappy mother hesitates between the alternatives of starvation and suffocation. Again, in other cases, the attack assumes the form of a sudden, almost soundless spasm, which does not relax till life is extinct. In very rare cases a slight but constant spasm is shown by stridulous breathing. In the common type of cases when the attack has occurred for the first time at night, the child may appear to be quite well on the following day and there may be no further return of the symptoms; but it more often happens that another attack comes on a few hours afterwards or at the same time on the following night. Sometimes the second attack supervenes almost as soon as the child has recovered from the first, in which event it is generally more serious, both in its character and duration, than the first. In severe cases, indeed, the paroxysms are so frequent that the child is scarcely out of one fit before it is again attacked. As a rule there is an entire absence of pyrexia in these cases, though sweating of the head, so characteristic of the rachitic constitution, is almost always present. Now and then the patient may look healthy and may even be plump, but on closer examination it will be found that the muscular system is weak, that the child is

easily fatigued, and that it shows other signs of feeble organization.

*Diagnosis.*—The absence of fever and the obstinately intermittent nature of the affection differentiate it sufficiently from laryngeal diphtheria (croup) and catarrhal laryngitis. Paralysis of the abductors—a very rare affection in childhood—might, however, be mistaken for spasm of the adductors, and it is thus important to carefully distinguish between these two conditions. In the paralytic cases there is, as Dr. Marshall Hall[1] has pointed out, "*a constant but partial closure*" of the glottis, the vocal cords never being abducted from their paralysed position, but always leaving a small opening through which the air can pass. In spasm of the adductors, on the other hand, there is *inconstant but complete closure of the glottis;* in other words, there is considerable movement of the cords, which are at one moment widely separated and at another so closely approximated that air cannot pass through the glottis. The symptom in the one case is constant dyspnœa, increased on the slightest exertion, whilst in the other it is occasional dyspnœa, with complete intermission between the attacks. This, however, is not an absolute law, for on three occasions I have seen slight constant stridor in the case of children in whom the other symptoms were of a spasmodic character (carpo-pedal contractions and convulsions). Not unfrequently the question can be determined by laryngoscopic examination.

*Pathology.*—The disease was for a long period regarded as cerebral, but the brilliant discoveries of Marshall Hall[2] led that eminent physiologist to seek for the invariable cause of the disease in some gross form of local irritation operating in a reflex manner. Hence he described it[3] as originating "in the trifacial in teething, in the pneumogastric in over or improperly fed infants, and in the spinal nerves in constipation, intestinal disorder, or catharsis." "This view," he observes, "is entirely new, and is the only true one." The tendency of modern thought has been, however, rather opposed to the explanation of laryngismus by the reflex theory, and the weight of evidence points to the probable existence of molecular changes in the nerve-centres as the essential cause of the phenomena. These changes are the result of mal-nutrition affecting all the structures of the

[1] Op. cit. p. 77.
[2] "Philosoph. Trans." June 20. 1833.
[3] "The Nervous System, &c." 1841, p. 171.

body. We know that convulsions may occur from simple anæmia of the brain, as in a healthy parturient woman from severe hæmorrhage, and there is every probability that the convulsions of children—of which laryngismus is only a form—are often due to an analogous condition. Though spasm of the glottis is most common during the period when the child is cutting its teeth, the influence of dentition has probably been greatly over-estimated, the relation of the latter condition to laryngismus being seldom an etiological one. The dental system, like certain other parts of the organism—especially the nervous economy—undergoes great developmental changes in the first year or two of infantile life, but spasm of the glottis can seldom be directly attributed to irritation of the gums. Over-feeding and bad feeding are, so far as their ultimate results are concerned, equivalent terms, and, like intestinal disease, operate more by causing mal-nutrition of the nerve-centres than through reflex action. Löschner[1] has endeavoured to show that in all cases of laryngismus there is vascular engorgement of the brain and its membranes from mechanical obstruction of some kind; but this view cannot be entertained, for laryngismus is often absent when obstruction actually exists, and, on the other hand, in fatal cases of the affection there is often no evidence of vascular engorgement of the brain. The influence of rickets must now be briefly considered. Elsässer's explanation that rickets produces the disease by causing a soft condition of the occipital bone, which permits pressure on the brain, is now quite exploded, and Steiner has put forth a much more ingenious theory. He points out that irritability of the nervous system is one of the most marked features of laryngismus. This irritability is increased, if not caused, by the rachitic condition in the following manner: the lateral flattening of the thoracic parietes, and the consequent diminution of the capacity of the chest, leads to more superficial respiration, and therefore to increased frequency of the respiratory function; this necessitates greater activity of the heart, greater wear and tear of the system, and consequent cerebral irritation. The two conditions are probably, however, coincident results of a certain general condition of mal-nutrition.[2] Looking at the immediate

[1] Op. cit.

[2] The word "rachitis" was coined by Glisson ("Tractat. de Rachitide," London, 1650) from its resemblance to the popular term

phenomenon of the disease, it must be regarded as a spasm of a limited number of muscles, brought about by an abnormal condition of certain nerve-centres. The various nerve-centres, as Dr. Hughlings Jackson[1] has pointed out, are probably not knit together so closely in the infant as in the adult, and a partial convulsion—such as is seen in laryngismus—points to an imperfect union of different sections of the nervous system. Dr. Jackson explains the occurrence of the carpo-pedal contractions in children in the same way, suggesting that the centre for the limbs is not so fully developed in young subjects, and hence that spasms of certain groups of muscles may take place which would be impossible in adults.

*Prognosis.*—According to the Registrar-General's Reports, this disease rarely proves fatal, only about 600 cases being returned annually for England and Wales. It is probable, however, that many cases of laryngismus are certified as "croup," whilst many others appear under the head of "convulsions" and "rickets." We must therefore judge of each case on its own merits, the age and strength of the patient, and the severity of the attack being the principal factors to be taken into consideration. The prognosis also depends on the character of the paroxysm and its supposed cause. Those cases due to defective feeding, if not too advanced when first seen, generally do well, whilst those due to obvious cerebral irritation are more frequently fatal. The length of the intervals between the paroxysms is a good prognostic guide; the longer the interval the greater is the chance of recovery.

*Treatment.*—The treatment must be two-fold; first, to relieve the spasm; and, secondly, to remedy the general condition which causes the fits. The immediate treatment usually falls to the nurse or the mother, and the attack has often passed off—sometimes, indeed, life is extinct—before the practitioner arrives. The little patient should be raised, and placed in a sitting posture; he should then be slapped

"rickets" by which the affection was previously known in England, whilst at the same time its resemblance to *ῥάχις*, the spine, gave it a learned appearance. The word "rickets" is probably derived from *rucket*, a provincial word (allied to the Danish *skrukke*, to cluck like a hen), meaning to breathe with difficulty—rickety children, with their pigeon-breasts and flattened sides, always breathing feebly, and often dying from bronchitis and pneumonia, as well as laryngismus.

[1] "Russell Reynolds' System of Medicine," vol. ii. p. 220.

on the back, cold water should be dashed in the face, and ammonia or strong acetic acid held to the nose. If these remedies are not successful the warm bath should be used; or, better still, the lower part of the child's body should be placed in a bath at 95°, whilst cold water is dashed in its face. Emetics may be given directly there is a sign of stridor, for when the paroxysm is present the child cannot drink. Steffen suggests that apomorphia may be injected under the skin, in order to excite vomiting; and the great advantage of this remedy is that it can be used when the child is unable to swallow. A favourite remedy in Germany, when the jaws are not closed, and one that is highly successful, is tickling the fauces with the finger or a feather, until vomiting is produced. Depressing enemata, such as tobacco, have likewise been recommended, but their use is attended with considerable danger. An injection of twenty or thirty drops of tincture of assafœtida in an ounce of warm gruel is, however, a safe and useful remedy. The inhalation of chloroform often at once relieves the spasm, but anæsthetics of course must be used with great care, and cannot be employed with safety by non-professional persons. Tincture of castor has several times proved of service in my hands, but musk is still more valuable. Musk may be administered during the attack, if the child can swallow; if not, this drug should be given as soon as the child can take it. The following is the formula which I am in the habit of employing:—℞. Moschi gr. iss, Sacch. Alb. gr. ij., Pulv. Acaciæ gr. ij. Syrup. Aurantii Flor. ℥xx. Aquam ad ʒj. The immediate cause of the attack should if possible, be ascertained. If the fit comes on during sucking, either from the leather-teat of the bottle, or whilst the child is at the breast, it must be fed, as Flesch insists, with a very small teaspoon—no matter how difficult at first it may be to get nourishment taken in this way.

The attack having passed off, the general condition of the child must be attended to. A brisk, but not too powerful, purgative should be administered to get rid of any irritation that may exist in the primæ viæ. Mercurial purgatives, such as calomel or grey powder, in combination with rhubarb or scammony, and an alkaline carbonate, are the most serviceable drugs for this purpose. The musk-mixture may generally be continued with advantage for twenty-four or thirty-six hours; and if the fits have occurred at night a small dose of chloral (gr. v.) should be given at about six or seven

o'clock in the evening. After thirty-six hours, it is generally desirable to bring the child under the influence of bromide of potassium, five grains of the salt being given three times a day. The greatest attention should be paid to the proper administration of food, both as regards frequency, quantity, and quality. It is most important that a sufficiently long interval—varying according to the age of the patient—should intervene between the feeding hours. If the child has been brought up by hand a wet nurse should, if possible, be at once obtained; but if this is impracticable, the child's diet should be confined to animal food. Cows' milk, diluted with an equal portion of water, or undiluted asses' milk, may be given. Thin beef tea also forms an excellent food for these children under six months of age, and as soon as the teeth are cut, finely chopped or pounded meat may be allowed. Cod-liver oil is a useful article of food in this affection, and should be taken regularly for some months. On the other hand, farinaceous articles must be absolutely forbidden.

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### Spasm of the Glottis in Adults.

This affection attacks adults under two conditions. Thus it may be a neurosis or may be the result of direct irritation of the larynx, such as we see in cases of laryngeal œdema or polypi, and when foreign bodies become impacted in the larynx. In these latter conditions the spasm is a dangerous complication, which can only be overcome by dealing with the essential disease or accident. In this article, however, spasm of the glottis will only be considered in so far as it occurs as an idiopathic affection, or in some rare cases as a reflex phenomenon. Spasm of the glottis in adults usually affects women, and the statistics of fatal cases extracted from the Registrar-General's Returns (see page 480), which point to an opposite conclusion, are probably based on cases in which the spasm was a condition superadded to organic disease, or traumatic injury. In adults the affection is generally regarded, with justice, I think, as an hysterical phenomenon. In the ordinary manifestations of acute hysteria the paroxysm generally culminates in a deep stridulous inspiration, which in severe cases is followed by temporary arrest of respiration and even opisthotonos. The condition indeed, as Dr. West has pointed out, is closely allied to the laryngismus of

children. So likewise when spasm of the glottis becomes chronic—or perhaps it would be more correct to say frequent—the subjects of the affection are usually hysterical women. I have occasionally, however, seen the condition persist during the most profound sleep, a circumstance which shows that it may occur quite independently of hysteria.[1] In the case of adults, as in that of children, irritation of one of the recurrent nerves may give rise to an attack.[2] The dyspnœa and stridor are often very great, but I have never met with a fatal case of functional character. On laryngoscopic examination the mucous membrane may appear of a perfectly healthy colour, but there is often slight congestion, and not unfrequently a small quantity of viscid secretion is expectorated from time to time. The vocal cords can be seen separating for an instant and then becoming spasmodically approximated. The sensibility of the larynx is not generally altered, and I have frequently introduced the laryngeal sound without exciting coughing. Inhalations of chloroform or hot steam often give rapid relief. The former need not be given so as to produce insensibility. I generally order 40 minims to half a pint of water at 150°. The same quantity of chloroform should be added every five minutes, until some relief is obtained. The preparations of conium, especially the Vapor Conii of the Throat Hospital Pharmacopœia, will be found very useful, and I have seen the spasm yield immediately to the inhalation of the smoke of burning stramonium or datura tatula. Valerianate of zinc is a useful remedy, especially in combination with assafœtida (Pil. Zinci Valer. : Throat Hosp. Ph.).

Where medicated solutions have to be applied to a larynx in which spasm is very easily excited, the patient should be directed to hold his breath during the time the application is being made and for a second or two afterwards, and to recommence breathing very gently, and only through the nose.

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### Nervous Laryngeal Cough.[3]

This affection may perhaps be more appropriately treated in connection with spasm of the glottis than in any other

[1] "Med. Times and Gaz." Nov. 15, 1862.

[2] See a case by Dr. Budd, "Med. Times and Gaz.," Feb. 6, 1859.

[3] The subject of whooping-cough covers such an extensive area of pathology and therapeutics, and has been the subject of so many monographs, that, though regarding it as a neurosis in which the

section. In its etiology nervous cough closely resembles laryngismus stridulus, being generally the result of some peculiar condition of the nervous system. Occasionally also, as in that complaint, it is the result of reflex irritation in the intestinal tract. The term "nervous laryngeal cough" is used to describe a shrill, often indeed extremely metallic, cough, which, in the entire absence of any laryngeal or pulmonary affection, occurs in paroxysms, and lasts for many hours each day, only ceasing when the patient sleeps at night. Sometimes it prevents the sufferer from getting any sleep, or coming on in the night keeps her awake for many hours. The subjects of the disease are generally young girls from 16 to 20, but I have met with it among boys of 14 and 16, and I have seen it several times in children between 5 and 14 years of age. The cough has frequently a very peculiar and even startling sound, being often deep and vibratory, or even occasionally resembling the barking of a dog or the quacking of a duck. Two cases have come under my own notice in which the cough was remarkable for extraordinary loudness. In one patient, a boy of sixteen, the cough lasted three weeks, coming on every three or four minutes, but passing off in a couple of seconds on each occasion. The volume of sound produced was most astonishing, and was compared to the deeper notes of a clarionet, blown with great violence. In another case, that of a young lady, the cough was so loud and so constant, that her friends were required by the proprietor of the hotel in which she was staying to have her removed, as she was a nuisance to all the other guests. Examination with the laryngoscope revealed nothing abnormal in these cases, nor was the general health affected. In very rare instances the peculiar sound of the cough is absent, its almost uninterrupted continuance on the one hand, and the healthy condition of the larynx and absence of any bronchial inflammatory affection on the other, alone showing the nervous character of the phenomenon. Rühle[1] has observed that in nervous cough there is usually no expectoration, but this is not an absolute rule. The affection may continue for weeks or months, and I have

laryngeal nerves are largely concerned, I feel it is impossible to touch on the subject in this manual. The fact that the disease is treated with considerable detail in the various text-books of medicine, makes me adopt this course with less regret than I should otherwise experience.

[1] Op. cit.

known one case in which, after lasting for years, it was followed by such severe spasm of the glottis, that tracheotomy became necessary. Generally, however, a very favourable prognosis may be given. The patient scarcely ever loses health, and the constant loud cough is often more annoying to the family than it is to the individual affected. The most certain means of curing this troublesome affection is afforded by a sea voyage; but owing to the age and sex of the patient, there are often difficulties in carrying out this plan of treatment. The change and variety of scene experienced in travelling on the Continent will sometimes effect a cure, and I have known a temporary residence at the seaside prove efficacious. Where it has not been possible to get change of air for the patient, I have sometimes found satisfactory results follow the use of sedative or anæsthetic inhalations; but these remedies, on the other hand, are often disappointing. Laségue[1] has reported a case successfully treated by belladonna; but in a severe case that came under my care, atropine, given till its full physiological effects were produced, did not relieve the cough. Valerianate of zinc, in the form recommended in the last article, is sometimes useful.

## SPASM OF THE TENSORS OF THE VOCAL CORDS.

*Latin Eq.*—Spasmus tensorum chordarum vocalium.
*French Eq.*—Spasme des tenseurs des cordes vocales.
*German Eq.*—Krampf der Spänner der Stimmbänder.
*Italian Eq.*—Spasmo dei tensori delle corde vocali.

Definition.—*Spasmodic action of the tensors of the vocal cords, giving rise to a voice which is feeble, jerky, and intermittent.*

*Etiology.*—This affection must be a very rare one, for I have only met with thirteen cases; eleven of the patients were men and two women. All were over twenty-five years of age, and all but two were more than thirty-five years. Of the men, ten were clergymen and one a barrister. The women were both compelled to speak constantly to deaf relatives.[2] In several instances the patients attributed their

[1] "Archives Générales," May, 1854.

[2] For details of some cases, see "Hoarseness and Loss of Voice." Second edition, 1868, p. 66, et seq.

complaints to catching cold, and, in their cases, the onset was sudden, but in other instances the development of the affection had been very gradual. The fact that such a large number of patients were clergymen would tend to show that the affection is due to some abnormal mode of using the voice.

*Symptoms.*—The sound of the voice is so peculiar in these cases, that from it alone they can, as a rule, be easily diagnosed. The patient is often able to produce some notes, either in his own natural voice or in a slightly muffled tone; but whilst speaking in this way, the current of the voice seems to be partially interrupted, and the sound conveys the idea of an arrested action of the respiratory muscles. In fact, it is very much like the straining and rather suppressed voice of a person engaged in some act requiring the prolonged and steady action of the expiratory muscles (parturition, defæcation). The patients often complain that they "cannot get their voice out." After speaking a word or two, or even several sentences, in this peculiar tone, the patient may again utter a few words in a comparatively healthy voice, and then may immediately relapse into the diagnostic intonation. In my experience no approach to the spasm is perceived, as long as the patient whispers, but directly the voice is sounded it becomes apparent; Schech, however, has reported a case in which the spasm occurred in a minor degree in whispering. In some cases the spasm is diminished by exertion (such as going up-stairs, or walking quickly). This has appeared to me to be due to exhaustion of the expiratory muscles; but, perhaps, it may be that the quickened circulation caused by the exertion had some beneficial influence on the spasm. In one case, on the other hand, exertion increased the spasm. The tense condition of the vocal cords can occasionally be perceived with the laryngoscope, but this is not always possible. Their surface, as well as that of the rest of the mucous membrane of the larynx, is usually congested. Schnitzler[1] and Schech[2] have reported cases somewhat similar to those which I have described. The latter considers that the aphonia is due both to the tense condition and the spasmodic approximation of the vocal cords. Under the head of "Stammering of the Vocal Cords," Dr. Prosser James[3] has apparently described this affection in the

[1] "Wien. Med. Presse," 1875, Nos. 20 and 23.

[2] "Ueber phonischen Stimmritzenkrampf, Aertzliches Intelligenzblatt," 1879, No. 24.

[3] "Lancet," Nov. 15, 1879.

case of "a clergyman, who suffered from the disease in an aggravated degree, and was deeply distressed by his consciousness of the fact, that though he kept on reading the service, some of the words dropped soundless from him; a statement verified by friends who accompanied him, and assured me that his lips moved in the usual way for the utterance of words and phrases which were lost in silence."

*Diagnosis.*—The voice is so characteristic in these cases, that it at once distinguishes the disease.

*Pathology.*—I have never had an opportunity of making a post-mortem examination in a case of this disease, and it is highly probable that the pathological changes are of too subtle a character to permit of detection. The affection appears to me to be due to spasm, not only of the tensors of the vocal cords, but of all the muscles employed in expiration, especially the diaphragm. Schech regards the affection as "a co-ordinated neurosis of occupation, analogous to the cramp of writers, piano-players, and shoemakers," and thinks it is very doubtful whether the disease is central or peripheral; in the latter case, he remarks, it may be either neuropathic or myopathic.

*Treatment.*—After trying every kind of treatment, local and general, stimulant and sedative, I am unable to speak in favour of any method. My own patients[1] who derived temporary benefit from treatment ultimately relapsed, and I am not aware of a single example of the affection, in my own experience, in which a permanent cure was effected. In one of Schech's two cases, although the patient left him uncured, he heard that the voice was ultimately restored; the other patient was not benefited. Schech proposes as treatment, at first, absolute rest of the voice, and the constant current percutaneously, and afterwards methodical vocal exercises and endo-laryngeal galvanism, whilst, at the same time, galvanization of the medulla and the brain should be carried out. He recommends nervine tonics, such as arsenic, bromide of potassium, zinc, valerian, atropine, and nitrate of silver; as general tonics, quinine, iron, iodine, and cod-liver oil. In obstinate cases hydropathy, consisting in douches on the head, neck, and spinal column may be tried. Schech's experience, as far as it goes, as well as the great number and variety of remedies he recommends, tend to conclusions similar to those which I have arrived at, viz., that the disease is nearly incurable.

[1] Op. cit.

## Chorea of the Larynx.

In addition to the various nervo-muscular affections which have been systematically considered, it is necessary briefly to refer to some conditions which may occasionally be met with. Thus, it has been asserted by Geissler[1] that the laryngeal muscles are subject to choreic movements. Schreiber[2] has reported the case of a girl, aged eighteen months, who suffered periodically from St. Vitus' dance, and during these attacks uttered, with great force, sounds which followed each other very quickly, and seemed to be *quarts* or *quints*. As long ago as 1829, Dr. Serres d'Alais[3] suggested that some cases of stuttering consist in a permanent choreic affection of the tongue or lips, and it is quite possible that the larynx may sometimes participate in the morbid action at the same time, or be independently affected. Previously, Dr. Krishaber[4] had called attention to "vocal asynergy," a term which he used to imply a want of command over the laryngeal muscles, generally occurring during some form of laryngitis, but sometimes arising idiopathically. The symptoms are not, as a rule, very obvious, except in the case of singers, who find a diminished power of inflecting the voice. Schech observes that there is neither sufficient strength nor duration in the tension of the vocal cords. The patient can neither hold a tone in singing, nor say several words in succession without interruption. In singing, the sound is suddenly cut short, and in reading aloud there is such an expenditure of force that the patient soon gets tired. Schech states that Ziemssen has noticed that the action of the adductors and tensors is unsteady and even oscillating. I have myself frequently observed a tremulous action of these muscles in persons of feeble power and highly nervous organization, but I have never made any special investigation in the case of choreic patients.

[1] Geissler: "Allgemeine Medicin. Central Zeitung." 1878, No. 95.
[2] "Wien. Med. Blätter." 1879, No. 15.
[3] "Mém. des Hôp. du Midi." 1829, p. 371.
[4] "Dict. de Sc. Méd." p. 681.

## MALFORMATIONS OF THE LARYNX.

*Latin Eq.*—Deformitates ingenitæ laryngis.
*French Eq.*—Vices de conformation du larynx.
*German Eq.*—Missbildungen des Kehlkopfes.
*Italian Eq.*—Vizi de conformazione della laringe.

DEFINITION.—*Congenital deviations from the normal size or form of the larynx, in adults generally consisting in the excessive smallness of the organ, and occasionally in the presence of growths or membranous webs, and more rarely of fissures. In monsters, the larynx is sometimes, but very rarely, absent; still more seldom, immensely large.*

Meckel[1] observes that he is not aware of the existence of any case of complete deficiency of the larynx; but he appears to have overlooked the fact that the organ is always absent in monsters whose lungs are not developed.[2] He describes, however, a case in which the malformation consisted in extreme smallness of the larynx, the subject being a man whose testicles were only half the natural size, and whose voice was of a female character. Dupuytren[3] also found the larynx very small in a eunuch, and Albers[4] has reported two examples of similar undersize in monorchids. Roederer[5] observed the thyroid cartilage much below the normal size, and an entire absence of the cricoid and arytenoid cartilages in a parasitic fœtus. One case is on record[6] in which the larynx was of excessive size, being described as "a roundish oblong cartilaginous body, extending even up to the palate," a condition which the author quaintly remarks was "portentous and incurable." The epiglottis is occasionally bifurcated,[7] and sometimes redundant. The latter condition was noticed by myself[8] in a case of cleft palate in which there was also in the central line between the arytenoid cartilages a distinct fissure which extended downwards on the

[1] "Handbuch der Pathol. Anat." Leipzig, 1812, vol. i. p. 482.
[2] Rokitansky: "Handbuch der Pathol. Anat." "New Syden. Soc. Trans." vol. iv. p. 3.
[3] "Bullet. de la Soc. Phil." Tome II. p. 195.
[4] "Erläuterungen zu dem Atlasse der Pathol. Anat." Bonn, 1832-47, Bd. ii. p. 103.
[5] "Comm. Soc. Gott." Bd. iv. S. 136.
[6] Hoffmann: "Disquisitio Corp. Human. Anatom-patholog." p. 201.
[7] "Lancet," Jan. 10, 1851.
[8] "Med. Times and Gaz." April 19, 1862.

posterior surface of the cricoid cartilage. In the case of bifurcation just referred to, the epiglottis formed two flaps which fell into the larynx, and from the first week of life gave rise to constant symptoms of laryngismus, causing death four months later. The larynx is occasionally more or less blocked up by congenital growths (see p. 301), and I have myself reported [1] one instance in which a membranous web between the vocal cords obstructed a considerable portion of the lumen of the larynx and caused persistent aphonia, till the twenty-third year, when I was enabled to remove the membrane and to restore the voice. As a rule, however, deformities of the larynx do not come within the province of treatment.

[1] "Trans. Path. Soc." vol. xxv. p. 35.

## SECTION III.—THE TRACHEA.

### ANATOMY OF THE TRACHEA.

The trachea is that portion of the air passages which stretches downwards from the larynx and terminates below by bifurcating into the right and left bronchi. Commencing at the inferior border of the cricoid cartilage opposite the lower margin of the fifth cervical vertebra (about an inch and a quarter above the vertebra prominens), it maintains its position in the middle line until it bifurcates opposite the third dorsal vertebra on a level with the interval between the second and third dorsal spines. At its upper part it is almost subcutaneous, but it gradually recedes as it descends, so that at the episternal notch it lies about an inch and three-eighths from the surface. The average length of the trachea in the adult is from four to four and a half inches, and its diameter varies from three-quarters of an inch to one inch in different specimens. Its width invariably bears a direct relation to the respiratory capacity of the lungs, being, *cæteris paribus*, greater in the male than in the female. Externally the trachea is rounded in front and on both sides, but somewhat flattened posteriorly, where the cartilaginous framework is absent; its internal configuration is of the same character, but is subject to considerable variation during life, owing to the contraction of the unstriped muscular fibres which cross the posterior part of the tube both between the ends of the cartilages and also opposite the intervals between them.

There are certain differences in the anatomical configuration and position of the bronchi and their relation to the windpipe which it is important that the practitioner should be acquainted with. The right bronchus, which is shorter and wider than the left, passes outwards almost horizontally to enter the root of the right lung on a level with the body of the fourth dorsal vertebra (third dorsal spine). The left bronchus, smaller and longer than the right, runs obliquely outwards and downwards beneath the arch of the aorta, passes in front of the œsophagus and descending aorta, and enters the root of the lung on a level with the body of the fifth dorsal vertebra (fourth dorsal spine), *i.e.*, about an inch lower than its fellow of the opposite side. The right bronchus has rather a wider aperture than the left, and the septum between them, or "bronchial spur," is often situated to the left of the median line,[1] causing foreign bodies to fall more readily down the right than the left bronchus, notwithstanding the more oblique direction of the latter.

[1] This was first pointed out by Goodall: "Stokes on Diseases of the Chest." In 100 cases examined by me during life I found the bronchial spur on the left side fifty-nine times, in the median line thirty-five times, and on the right side six times.

The trachea is in relation with a number of important structures throughout the whole of its course. Its cervical portion is covered by the sterno-hyoid and sterno-thyroid muscles, and in the median space between them by layers of the deep cervical fascia; it is also crossed by the isthmus of the thyroid gland which usually lies on the third tracheal ring; by the arteria thyroidea ima when present, and by the inferior thyroid veins. In the same region, but more superficially, are some communicating branches between the anterior jugular veins. The innominate and left carotid arteries are also anterior to it in the episternal notch as they diverge from their origin. Laterally, this portion of the trachea is in relation with the common carotid arteries, the lateral lobes of the thyroid body, and the inferior thyroid veins, the recurrent laryngeal nerves being placed in the interval between it and the œsophagus. The thoracic portion of the trachea is covered by the manubrium sterni with the origins of the sterno-hyoid and sterno-thyroid muscles, by the left innominate vein, by the commencement of the innominate and left carotid arteries, by the transverse portion of the aorta which passes in front of it to reach the left side, by the deep cardiac plexus of nerves, and at its bifurcation by the pulmonary artery where this vessel divides into its right and left branches. Laterally it is in relation with the pleura and the pneumogastric nerves, and also on the left side with the recurrent and middle cardiac branches of the left vagus and the left carotid artery. Posteriorly throughout its whole length the trachea rests upon the œsophagus, which separates it from the longi colli muscles and the vertebral column.

The trachea is supported by a framework consisting of from fifteen to twenty incomplete rings of hyaline cartilage, which surround the tube for about three-fourths of its circumference; the remaining posterior fourth as well as the interspaces between the rings are occupied by strong bands of connective tissue and unstriped muscular fibres. Each ring is between $1\frac{1}{2}$ and 2 lines in width, and on vertical section is plano-convex, the plane surface being placed externally. The rings have thus their greatest thickness at a point equidistant from their upper and lower borders, where they measure about one line from before backwards. Their borders as well as their extremities are rounded off, the latter being often slightly everted. The separate segments of the tracheal framework are usually more or less fused together, two or more adjoining rings being connected for a portion of their circumference, so as to present a branching appearance. These irregularities are most frequent and striking at the upper and lower parts of the tube. The first few rings are not uncommonly welded together into an irregular plate, while the last ring is invariably of a transitional form, presenting either an incurvation or a downward projection at the point immediately above the bifurcation of the tube.

The tracheal rings are bound to each other and enclosed by two layers of connective tissue; the inner layer is of loose structure, and crowded with glands; the outer consists of firm fibrous bands running mostly in a longitudinal direction, and including a considerable proportion of elastic fibres and a few transverse muscular bundles. Posteriorly the two layers of connective tissue enclose a comparatively strong layer of unstriped muscular fibres, running transversely between the ends of the rings, to the perichondrium of

which they are attached by means of small tendons; a few muscular fibres having a longitudinal direction are also met with external to the transverse fibres. The large amount of connective tissue and elastic fibres which enter into the structure of the trachea allows of that mobility which is essential in a tube subject to such constant variations in position from movements of the larynx and neck.

The internal surface of the trachea is lined by a mucous membrane which is continuous with that of the larynx, and the proper structures of which are intermingled with a considerable proportion of elastic fibres. A basement membrane bounds the mucosa, and sustains a laminated epithelium, the uppermost cells of which are columnar and ciliated. The submucosa is chiefly composed of comparatively strong bands of longitudinal elastic fibres, which freely anastomose with each other, and enclose between them the ducts of the numerous glands which lie beneath. These are most thickly distributed on the posterior wall, where they form a distinct layer between the submucosa and the muscular layer; but they also occur in considerable numbers in the interspaces between adjacent rings, and are only entirely absent in those portions of the tracheal lining which are in immediate contact with the inner convexities of the rings. The glands are of the racemose variety, lined with cylindrical epithelium.

The arteries of the trachea are mainly derived from the inferior thyroid, and form a superficial network from which venules pass to the adjacent plexuses of the thyroid veins.

The trachea derives its nervous supply from the pneumogastric and recurrent laryngeal nerves, and also from the sympathetic. Ganglionic enlargements can be traced in connection with the ultimate fibres.

## SURGICAL ANATOMY OF THE LARYNGO-TRACHEAL REGION.

The external contour of the laryngo-tracheal region has been described at page 202. The space may be regarded as bounded on each side in the upper part by the sterno-hyoid muscles, and in the lower part by the sterno-thyroid muscles, whilst the superior border of the thyroid cartilage above and the upper edge of the sternum below, may be considered as the possible limits of the region within which the air tube can be opened. Owing to the direction of the sterno-thyroid muscles, the space is slightly narrower below than above. It is true that an opening can be made at a higher level, *i.e.*, through the thyro-hyoid membrane; but in that case it is the pharynx which is laid bare. Division of the thyroid cartilage may also be practised, but this operation is very rarely performed, except for the removal of a body impacted in the larynx, or for the extirpation of a neoplasm which cannot be got rid of by an endo-laryngeal method. Even when a foreign body is firmly fixed, however, it can almost always be dislodged through an opening in the air-passage below the level of the thyroid cartilage; and the great importance (in relation to the vocal function) of maintaining the absolute integrity of this portion of the larynx cannot be too strongly insisted on. The two operations just referred to will be found described at pp. 324 and 331, and for practical purposes we may regard the space between the lower border of the thyroid

cartilage and the sixth ring of the trachea as the upper and lower limits of the tracheotomic region.

In performing tracheotomy, we cut through the skin and superficial cervical fascia (though the latter is rather a loose areolar tissue, containing more or less fat, than a distinct layer), and quickly reach the superficial layer of the deep cervical fascia; on dividing the latter structure we come upon a greater or less amount of fat and the two anterior jugular veins. In some cases the edges of the muscles on the front of the neck slightly overlap the anterior surface of the trachea, and have to be held back. Over the second, third, and fourth rings we see the isthmus of the thyroid gland, which, through the deep layer of the deep cervical fascia, is firmly adherent to the trachea. When these tissues have been pushed aside, we discover, adhering tightly to the front of the trachea, the deep layer of the deep cervical fascia, on division of which the tracheal rings are exposed. In dividing the trachea, it is important to remember that the mucous membrane is very closely adherent to the cartilaginous framework. In infants, the thymus gland rises half an inch above the level of the sternum, and it is frequently to be found as late as the sixth or seventh year; it may give rise to some complications by getting into the wound and obstructing the last stages of the operation. The innominate artery occasionally comes into view in "inferior" tracheotomy, and may be seen obliquely crossing the lower portion of the right half of the trachea. It is relatively higher in the child than in the adult. The left innominate vein is also often observed when the trachea is opened at a low level.

From a consideration of the vascular structures, the greater safety of opening the trachea in its upper part, that is, above the isthmus of the thyroid gland, will be readily appreciated.

The irregularities of the vessels deserve consideration, but they are rare, and even when present need not intimidate the operator. Sometimes the place of the anterior jugular vein is taken by a single central vessel, and in this case it is almost sure to be accidentally opened in performing tracheotomy. The most common irregularity of the vessels, however, consists in the presence of the thyroidea ima artery, which, when present, usually arises from the innominate trunk, but sometimes from the right common carotid, or the aorta. More rarely it is given off from the right internal mammary or right subclavian arteries. The thyroidea ima passes to the thyroid body in the median line close to the trachea.

In performing (crico-thyroid) laryngotomy, the tissues corresponding to those described in speaking of tracheotomy are met with in the first steps of the operation, but the isthmus of the thyroid gland, of course, does not come into view; the adipose tissue is generally less abundant, and the veins much less numerous. The crico-thyroid artery, which runs across the membrane of the same name and anastomoses with its fellow of the opposite side, is a small vessel, but as Chassaignac [1] first pointed out, its place is sometimes taken by the superior thyroid trunk itself.

[1] "Leçons sur la Trachéotomie." Paris, 1855, p. 9.

## TRACHEOSCOPY.

The examination of the trachea with the laryngeal mirror requires more patience than laryngoscopy, and it is not always possible to obtain a view of the whole tracheal surface.[1] The general principles upon which it is conducted are much the same as those which have been laid down under "Laryngoscopy" (page 227). It is absolutely necessary, however, that the parts should be strongly illuminated, a light which is sufficient for laryngoscopy being often quite inadequate for tracheal examination.[2] In order to bring into view *the anterior wall of the trachea*, especially in its upper part, the ordinary laryngoscopic position answers sufficiently well, but the patient instead of inclining his head backwards should hold it upright or bend it slightly forwards, at the same time stretching his neck a little, but not throwing the chin up too much. He should also sit rather higher than for laryngoscopy, so that his chin is just above the level of the observer's eyes. The patient being thus placed, the operator should slowly bring the laryngeal mirror into a more or less horizontal position by lowering its anterior edge. In this movement the whole length of the anterior wall from above downwards will gradually come into view. It may be added that during the change in the inclination of the mirror it is well to keep its distal margin rather further forward in the throat (*i.e.*, further away from the posterior wall of the pharynx) than in the case of laryngoscopy. *The posterior wall of the trachea* is most easily discovered by tracing the anterior wall of the trachea downwards till the bronchial spur and the orifices of the bronchi become visible, when by means of a still more horizontal inclination of the mirror the

[1] With practice, the difficulty greatly diminishes. Thus, selecting only those cases in which the larynx could be easily seen, and the mirror readily tolerated, I was able to examine the trachea well in only 13 out of the first 100 patients; in the second 100 the examination was successful in 21 cases; in the third 100 in 29 cases; whilst in the last 116 cases the bifurcation of the trachea was seen 47 times—*i.e.*, in 40 per cent.

[2] It is possible that the mirror recently invented by Nitze and Leiter, of Vienna (Electro-endoskopische Instrumente: Wien. 1880), in which the electric light (contained within the mirror) is actually introduced into the pharynx, may be of use for lighting up the tracheal canal. A constant flow of cold water which passes round the mirror, and through the handle to a reservoir, keeps the glass from becoming inconveniently heated.

lower portion of the posterior surface is brought into view. The upper third, however, is exceedingly difficult to see, and in a large number of cases altogether eludes observation.[1] *The sides of the trachea* can be easily seen by giving the mirror a slight lateral slant when the anterior wall is in the field of view. Türck [2] has pointed out that a tracheoscopic examination may sometimes be facilitated by slight external pressure of the trachea, especially in seeking the bifurcation, and he further states that it is occasionally advantageous to place the patient sideways on a chair and then to rotate his head so as to face the observer. On examining the patient in this position, parts of the trachea will often come into the field of the mirror which escape in the common method of examination, and it is not unfrequently possible to see a considerable distance down one or other of the bronchi.

When tracheotomy has been performed a small steel mirror may be introduced through the wound and a view of the canal thereby obtained, but as in these cases the disease is generally confined to the larynx, the examination of the lower part of the trachea is comparatively unfruitful.

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### The Tracheal Image.

The reflection of the trachea in the mirror has not the simple character of the laryngeal image. The latter is made up of a number of parts mostly situated in or near the same plane; the tracheal image, on the other hand, is the reflection of a long tract of mucous membrane seen only in perspective. Hence it is necessary briefly to describe four tracheal images, viz.—the anterior, posterior, the lateral, and the inferior.

*Anterior wall.*—The appearance of the anterior wall of the trachea in the field of view depends, as already remarked, on the angle at which the mirror is held. The image is rendered very characteristic by the prominent cartilaginous rings, and the greyish-red recesses between them. It varies, however, according to circumstances. Thus, in healthy persons, the colour of the interspaces depends in a great measure on the degree of illumination; when the light is not very powerful,

[1] In 17 out of 100 cases in which I was able to see the bifurcation, the upper third of the posterior wall of the trachea could not be brought into the field of vision.

[2] "Klinik der Kehlkopfkrankheiten," &c. p. 92.

the interstices are of a dull grey colour, but with a strong oxyhydrogen light they generally appear bright red. When the mirror is held so as to make an angle of 45° with the plane of the horizon, six to eight of the uppermost rings of the trachea can generally be counted; at an angle of 35° ten to twelve rings; at a smaller angle[1] the intercartilaginous spaces in the upper part are lost sight of as the result of perspective, and the corresponding rings often cannot be counted; several of the rings in the lower part of the trachea, however, now come into view, and on still further diminish-

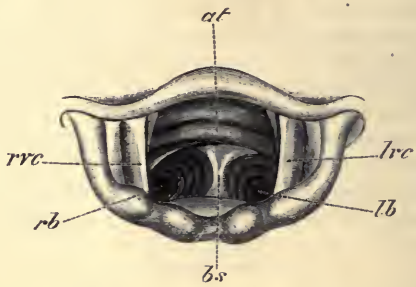


FIG. 99.—VIEW OF ANTERIOR WALL OF TRACHEA AND BRONCHI.

*at*, anterior wall of trachea; *rvc*, right vocal cord; *lvc*, left vocal cord; *rb*, right bronchus; *lb*, left bronchus; *bs*, bronchial spur.

ing the angle of inclination the orifices of the bronchi may be perceived.

*Posterior Wall.*—This wall, which is of a redder colour than the anterior, is often marked by transverse lines, which produce an appearance as if the cartilages actually extended across it. This effect, however, is really caused by the attachment of the ends of the cartilage to the muscular fibres at the back of the trachea, and the ridges thus produced, though apparently as close to each other as the cartilages, are really often half an inch or more apart, the intervening recesses being concealed by the perspective. In almost every examination the vertical angle on each side of the

[1] These angles are based on the supposition that the patient and observer occupy the exact positions described. It is, of course, obvious that the slightest change of situation will alter all the relations.

trachea (caused by the terminal joints of the cartilages) comes into view, and thus enables the observer to recognize with certainty the part he is inspecting.

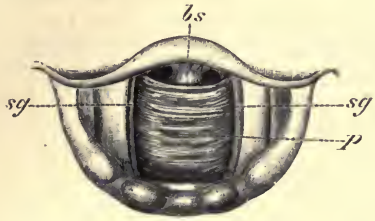


FIG. 100.—VIEW OF POSTERIOR WALL OF TRACHEA AND BRONCHI.

*bs*, bronchial spur; *sg*, sub-glottic region; *p*, posterior wall of trachea.

*Lateral walls.*—In these images the rings of the trachea can be very distinctly seen, as well as the vertical angle on each side already referred to.

*Inferior wall.*—The reflection of this portion of the trachea includes the bronchial spur and the orifices of the bronchi, and sometimes even from half an inch to an inch of the upper part of those canals. The spur, it must it remembered, is generally placed slightly to the left of the median line, so that if the mirror is held exactly at right angles to the central plane of the body, the observer can see down the right but not down the left bronchus. In connection with the image of the inferior wall it is necessary to notice the tracheal pulsation, a phenomenon which is most distinctly seen by watching the bronchial spur, and to which both Gerhardt[1] and Schrötter[2] have called attention. The pulsation corresponds to the cardiac systole, and appears to be due to the position of the windpipe between the aorta and the innominate artery. It can be seen most distinctly when the capillaries of the mucous membrane covering the spur are engorged.[3] I was able to observe it in forty-one per cent. of the cases in which the bronchial spur was visible. In twenty-three cases the bronchial spur was directed to the right side; in the remaining eleven cases, although pulsation could be perceived, the exact nature of the movement could not be accurately distinguished.

[1] "D. Archiv f. Klin. Med." Bd. ii. p. 543.
[2] "Sitz. d. k. k. Akad. d. Wiss." Bd. lxvi. 1872.
[3] Ibid.

## TRACHEAL INSTRUMENTS.

*Brushes, Forceps, &c.*—The various laryngeal instruments already described (page 242 *et seq.*) can be employed in treating diseases of the trachea, but the brushes and sponge-holders, if used, require to be longer below the angle. In tracheal affections insufflators are of great service, the same instruments being applicable for the purpose as those recommended for the larynx. The inhalations and sprays already described also answer equally well for the trachea. The common laryngeal forceps, however, can seldom be introduced into the windpipe, though the tube-forceps (page 257) will be found useful in extracting a foreign body, especially through an opening in the trachea.

*The Solid Atomiser.*—An instrument has lately been invented by Mr. Bell, of Newcastle-on-Tyne, which promises to be of great value in the treatment of tracheal affections. It consists of a small metal chamber, containing a very finely reduced medicated powder, which is kept in constant movement by the revolution of four little fans acting by clockwork. By an ingenious contrivance the powder is delivered at longer or shorter intervals of time at the will of the operator. By the aid of this instrument, medicated powders can be easily introduced, not only into the trachea, but into the ultimate bronchi and pulmonary cells.

*Galvanic Cautery.*—The use of galvanic cautery in endo-laryngeal operations was recommended in 1854 in his very first communication on the subject[1] by the actual inventor of this surgical method, the late Professor Middeldorpf, of Breslau. But although he even reported a case in which he had removed, *per vias naturales*, a growth probably originating from the right ary-epiglottic fold, yet as the growth appeared at the back of the mouth, the operation can scarcely be considered as endolaryngeal, and the merit of having first removed a neoplasm from the larynx by electric cautery remains with v. Bruns, who had also been the first to apply the laryngoscope in the operative treatment of this disease by simpler methods. In the year 1864 v. Bruns operated successfully with galvanic cautery on two patients[2] suffering from laryngeal polypus; and in the same year Professsor Voltolini, of Breslau, employed galvanic cautery in some endolaryngeal operation.[3] In 1866 and 1867 I operated on several cases[4] by this method. It is mainly to the enthusiastic exertions of Voltolini that the profession is indebted for the applica-

[1] "Die Galvanocaustik: Ein Beitrag zur operativen Chirurgie." Breslau, 1854, pag. 212, et seq.
[2] "Laryngoscopie und Laryngoscopische Chirurgie." Tübingen, 1866, pp. 367 and 398.
[3] "Die Anwendung der Galvanocaustik," &c. Wien, 1871, p. 143, et seq.
[4] "Growths in the Larynx," pp. 144-5.

tion of galvanic cautery to the treatment of laryngeal neoplasms; but in spite of his recommendation,[1] and notwithstanding the numerous improvements which have since been made in batteries and instruments,[2] the galvano-caustic method has not hitherto come into general use for treating the larynx.

[1] Op. cit. p. 25.

[2] In addition to the works already referred to, see v. Bruns: "Die Galvano-Chirurgie, &c." Tübingen, 1870; Schnitzler: "Laryngologische Mittheilungen," "Wiener Medizin. Presse," 1866-78; Böcker: "Ein Handgriff zur Anwendung der Galvanocaustik," &c.; "Berl. Klin. Wochenschrift," 1873, Nro. 30.

I have already stated at some length[1] my reasons for not recommending galvanic cautery for the destruction of *laryngeal* growths, the essential grounds of my objection to this method being that it requires the use of an exceedingly complicated apparatus where a simple one is equally efficacious. I now very rarely employ it except in the case of subglottic neoplasms. Schech[2] thinks that "hardness of consistency and vascularity of structure" are amongst the conditions which especially call for galvanic cautery, and in one case,[3] in which the growth was very dense, I found this method useful. With regard to the other point I can only say that I have operated successfully on the most vascular neoplasms[4] with common cutting forceps without any evil results, and therefore do not see the necessity of galvanic cautery in such cases. It appears to me that it is only in cases of small growths situated in the upper part of the trachea that this method of extirpation is especially indicated. It is difficult to make use of the forceps in such cases, and an instrument in which the destructive process is effected by mere contact appears particularly indicated.

Galvanic cautery is also very useful for destroying enlarged veins, whether situated in the pharynx or larynx, and I have employed it for this purpose for many years. It has been recommended with the same object by Mr. Lennox Browne[5] in obstinate cases of chronic pharyngitis. For destroying nasal polypi galvanic cautery was first recommended by Voltolini, and it has since been successfully employed in treating this class of affections by Drs. Thudichum, Michel, Browne, Semon, and myself. The method has also been used in performing tracheotomy (see "Bronchotomy"), but for this purpose it is not likely to come into vogue. Lastly, I have employed galvanic cautery with success in some cases of fibrous goître. The application of this method will be again referred to in dealing with the various diseases in which its use has been indicated.

[1] "Growths in the Larynx," pp. 82 and 83.

[2] "Die Galvanocaustik," &c.; "Aerztliches Intelligenzblatt," 1877, Nro. 43 and 44.

[3] "Growths in the Larynx," Case 49.

[4] Ibid. Case 89.

[5] "The Throat and its Diseases," p. 102.

Galvanic cautery batteries may be conveniently divided into two classes, viz., those which require two different acids (nitric acid and dilute sulphuric acid), with a porous intervening cell, and those which require only one solution. Of the former kind the best is perhaps that of Grove[1]; of the latter, Grenet's[2] battery, in which a single fluid—a mixture of bichromate of potash and sulphuric acid—is used, with

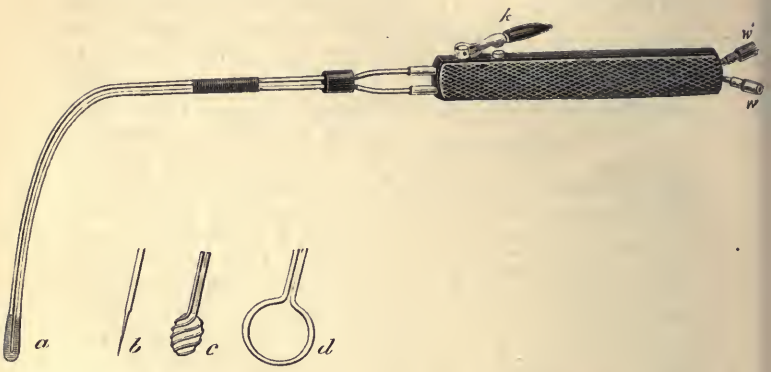


FIG. 101.—THE GALVANIC CAUTERY ELECTRODE.

*k*, the key by which the current is established; *w* and *w'*, metal tubes which receive the wires of the battery; *a*, the flat side of the ordinary galvanic cautery point; *b*, the same seen in profile, one-third of size; *c*, another form of galvanic cautery point; *d*, loop used in connection with an écraseur similar to that described at page 260.

two metals, is the type. Although for large operations, such as the removal of the breast or tongue, where a uniform and somewhat prolonged action is required, batteries on Grove's principle should always be employed; for minor operations on the larynx, trachea, and nose, some modification of Grenet's instrument will be found to answer perfectly well. The most convenient instrument of the kind is that

[1] Bunsen's modification of Grove's battery in which the sheet of platinum is replaced by a cylinder of carbon is also an excellent instrument, and is less expensive than Grove's.

[2] Smee's battery, which consists of a platinized sheet of silver placed between two vertical plates of zinc, and immersed in a single fluid (dilute sulphuric acid), answers extremely well for electric cautery, but it is more expensive and less manageable than Grenet's instrument.

of Dr. Dawson,[1] of New York, but I can also strongly recommend Leiter's,[2] which the practitioner, without touching the exciting fluid, can charge and uncharge by pressure on a little india-rubber ball.

Whichever battery is used, there should be as few breaks as possible in the conducting apparatus.[3] The points which I most frequently employ are shown in Fig. 101. In dealing with pharyngeal and nasal polypi I have occasionally used galvanic snares with a handle similar to that figured on page 260,[4] but I have not found that cautery can be conveniently carried out in the larynx or trachea with this form of apparatus. Instruments of very delicate construction have been made under Dr. Schech's[5] direction, but I have never used them myself.

## Tracheotomy Instruments.

*The Ordinary Canula.*—As will be hereafter shown in dealing with the history of the subject, the tracheal canula has undergone various modifications since it was first invented. The instrument commonly employed consists of a silver tube, the curve of which corresponds to the arc of a quadrant. It is introduced into the trachea in such a way that the larger end of the instrument looks directly forwards and projects a little from the surface of the

[1] This battery is composed of two cells, each of which contains three zinc and two platinum plates, measuring 4½ by 6 inches. The zinc plates are perforated and fixed half an inch apart, and a platinum plate is held in position between them by means of uprights. On each side of the platinum plates are hard rubber pumps, which, when worked up and down by means of a small handle, drive the exhausted fluid away and allow fresh fluid to come in contact with the plates. A power equal in intensity to that obtained from large batteries is thus secured; but the pumps do not require to be used in laryngeal and nasal operations. The entire battery measures 8½ inches in height, 6 inches in width, and 4 inches in depth, and only requires two and a half pints of the ordinary mixture of bichromate of potash and sulphuric acid.

[2] Sold by Krohne, Duke-street, Portman-square.

[3] I formerly used thick conducting wires covered with gutta percha, but afterwards, for a time, I employed fine wires in order to facilitate the manipulation of the instrument. I have returned to thick wires for the sake of improved conduction, and by resting the wires on my right shoulder I contrive that a very small portion should hang on the instrument.

[4] Manufactured by Mayer & Meltzer.

[5] Sold by Albrecht, surgical instrument maker, at Tübingen.

wound, and it is prevented from falling into the windpipe by means of a transverse collar, or shield, articulated to it by a joint which permits of considerable play between the two portions of the instrument. The ends of the shield slant slightly backwards so as to correspond with the curve of the neck, and each is perforated by a large oval opening (Fig. 104, *t*) for the tapes,[1] by means of which the instrument is held in place. The lower extremity of the tube is directed downwards and its axis should correspond with the long axis of the trachea. In order to facilitate introduction, the canula is, or ought to be, fitted with a pilot consisting of three portions, viz., a firm handle, a shank which passes down the canula, and a conical end which projects from the distal extremity of the canula when the instrument is prepared for use. The canula is also provided with an inner tube which can be easily removed and cleaned, and should be a little longer than the canula proper (Fig. 103) so as to provide against the accumulation of mucus. To prevent its being forced out by coughing the inner tube can be bolted to the shield.

*Durham's Canula.*—The principal objection to the

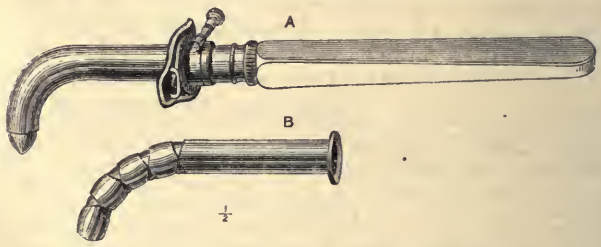


FIG. 102.—DURHAM'S RIGHT-ANGLED CANULA.

A, the canula, with pilot; B, the inner tube.

tube just described is that, from the nature of its curve, it often irritates or even cuts into the anterior wall of the trachea, and in inventing the right-angled tube with its long horizontal, and short vertical portions, Mr. Durham[2] has made a very important advance in this department of mechanical surgery. Other improvements have also been

[1] In most of the English instruments there is only a narrow vertical slit, through which it is often very difficult to pass the tapes.

[2] "The Practitioner," April, 1869.

introduced into the instrument.[1] It has already been pointed out that the depth of the trachea from the surface varies in different parts of its course (page 498), but its position also depends on the condition of the neck—whether it is thin or fat, normal or swollen. To meet these varying conditions, in Durham's instrument, that part of the horizontal portion of the canula which passes into the neck can be shortened or lengthened, and fixed to the shield in the desired position by means of a screw (Fig. 103, *sc*). This screw arrangement for varying the length of the tube, is, of course,

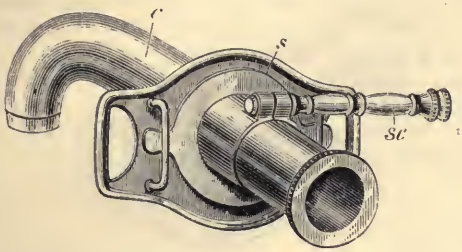


FIG. 103.—THE TEMPORARY RIGHT-ANGLED CANULA (DURHAM'S).

*c*, the transverse portion of the canula, which can be pushed a short or longer distance through the shield *s*, and then fixed by the screw *sc*.

only required for the temporary canula, and may be dispensed with when a permanent tube is inserted. The anterior extremity of the canula proper should, in all cases, project about a centimetre in front of the shield, and the anterior extremity

[1] On the ground that the trachea is not placed vertically in the neck, but slants backwards as it descends, Mr. B. W. Parker ("Med.-Chir. Trans.," vol. lxii., 1879) recommends that the tracheotomy-tube should be made at an obtuse angle. In cases of stenosis, where a very long tube has to remain in the trachea, Mr. Parker's suggestion may be of use, but even in these cases König's tube (see "flexible canula") would most probably be found more convenient. In ordinary cases the rectangular tube answers perfectly well, the extreme shortness of its descending portion reducing the backward inclination of the trachea to a matter of no importance. In order to introduce Mr. Parker's tube into the throat without hurting the patient, it is necessary to use a pilot, similar to that supplied with Mr. Durham's instrument; but for the purpose of permitting the introduction of the inner tube without employing lobster-joints, Mr. Parker has the angular portion and contiguous parts of the upper surface of his inner tube cut away. It need scarcely be pointed out that this arrangement greatly diminishes the value of the inner tube, as the secretions come in contact with a large surface of the outer canula.

of the inner tube should have a little projecting ridge by which it can be easily taken hold of. This arrangement is much more convenient than that of the older tubes in which the orifice of the canula is flush with the shield, and wire loops have to be attached to the inner canula in order to admit of its removal; for these loops are apt to get in the way when the patient desires to close the tube with his finger for speaking. Owing to the shape of the canula in Durham's instrument, the inner tube seldom requires to be fixed, as in the common canula; but if special security is necessary, the permanent tube can

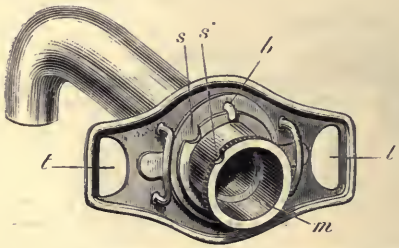


FIG. 104.—THE PERMANENT RIGHT-ANGLED CANULA.
(Durham's, slightly modified.)

*m*, mouth of inner tube; *b*, bolt which fixes in inner tube; *s*, slot, which, when turned round opposite to *b*, unlocks the bolt, and enables the canula to be withdrawn; *s'*, slit at orifice of mouthpiece of inner canula, which exactly corresponds in position and moves with *s*. From its superficial position, *s'* can be easily felt, and the patient or practitioner can readily guide the inner tube into the desired position, whether for the purpose of introduction or removal.

be provided with a little bolt (Fig. 104, *b*), which is much more convenient than the clumsy arrangement of the common instrument. The angular and descending portions of the inner tube of the right-angled canula, as well as the corresponding portion of the pilot, have to be made with joints on the lobster-tail principle. A set of tracheotomy tubes should contain four sizes, with the following diameters:—No. 1, one centimetre; No. 2, nine millimetres; No. 3, seven millimetres; No. 4, five millimetres. The length of the tubes should be respectively seven centimetres, six centimetres, five centimetres, and four centimetres. These lengths, however, mainly depend on variations in the length of the horizontal position, the vertical part being only from half-an-inch to three-quarters of an inch in length. Owing to the shape of the tubes, Durham's instrument remains in the long axis of the trachea, and should be fixed in a central position so that

it does not touch the walls of that canal. The only argument that has been alleged against its use is, that mucus gets easily attached to the joints of the inner tube, and that the joints themselves are apt to become corroded. As regards the former complaint, I have not found it worthy of any serious consideration, but no doubt the condition of the joints ought to be frequently and carefully inspected.

*Fuller's Canula.*—In an instrument devised by the late Dr. Fuller,[1] a slip of about one-eighth of an inch in diameter is removed from both the upper and lower walls of the tube, the two lateral portions remaining. These are kept in place by being attached to the collar. By holding the two sides of the tube tightly together, the size of the instrument is greatly diminished, and its extremity reduced to a mere point, which can be very easily introduced into the windpipe. The inner tube, which is afterwards passed in, separates the outer segments and the whole becomes compact.

*Gendron's Canula.*—Gendron[2] has invented a somewhat similar instrument, the tracheal tube consisting of two segments of a canula which are separated after introduction into the throat by means of a screw on a transverse bar.

I do not, however, recommend either Fuller's or Gendron's instruments, for they cannot be so easily introduced as the rectangular tube when provided with a good pilot; the projecting edges of the outer tube are also very apt to cause ulceration, and from the canula and shield having a fixed union the instrument is much more uncomfortable to wear.

*Hard India-rubber Canula.*—I have occasionally used vulcanite tubes, but I am not aware that they possess any advantage over silver ones, and they are open to the objection that they have to be made considerably thicker than the latter; thus, with the same external diameter, the lumen of the vulcanite tube is smaller. They are also much more likely to break, and hence I do not consider their employment to be altogether devoid of danger.

*Soft India-rubber Canula.*—These tubes were first introduced by Mr. Morrant Baker.[3] They are not recommended for use until a few days after the operation, when they are said to be more comfortable to the patient than tubes of a more rigid construction. On the ground of thickness they

[1] "Trans. Med.-Chir. Soc." vol. xl. p. 69, et seq.
[2] Linhart: "Operationslehre," 2nd ed. p. 652.
[3] "Trans. Med.-Chir. Soc." vol. lx. p. 71.

are open to the same objection as the vulcanite instruments, and they do not permit the use of an inner tube. They, therefore, have to be removed rather frequently, and are thus likely to lead to irritation of the tracheal wound.

*Flexible Metal Canula.*—In cases of compression of the trachea from goître or other tumours, it is sometimes necessary to use a very long tube, and under these circumstances a canula which is flexible, but yet sufficiently rigid to resist pressure, is most suitable. In König's[1] tube the curved portion is like an ordinary canula, the upper three inches of the descending part is made of silver wire spirally twisted, and the lowest inch is again a solid tube. This canula has answered its purpose in several cases.

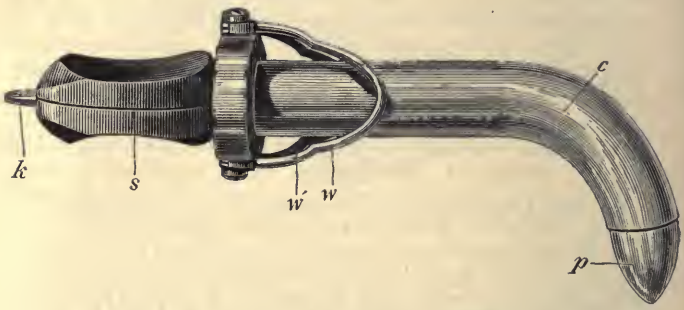


FIG. 105.—THE POCKET CANULA (LARGEST SIZE).

*c*, canula; *w* and *w'*, wings, which, when not in use, lie flat against the canula, but which, when ready for service, are brought forward and form the shield; *p*, pilot, projecting from extremity of canula; *k*, knife, projecting from handle, in order that it may be more easily withdrawn; *s*, slit in handle, showing how it opens when withdrawn from the canula.

*Pocket Canula.*—To meet the emergency of sudden suffocation,[2] my pocket canula will be found very convenient.

[1] Max Schüller: "Tracheotomie, Laryngotomie, and Exstirpation des Kehlkopfes." "Deutsche Chirurgie." 1880, pp. 90 and 91.

[2] Some years ago I was called to a gentleman in the immediate neighbourhood of my house, but knew nothing about the case until I arrived. Finding that there was considerable œdema, I returned home for my tracheotomy instruments; but though only absent for a few minutes, I found, on my return, that he had ceased to breathe. I at once performed tracheotomy, and by means of artificial respiration the patient was restored to full consciousness and apparent vigour; but he died thirty-six hours later, and at the post-mortem examination it was discovered that one lung was completely collapsed, a condition which must have arisen when the breathing was temporarily suspended. Since that time I have always endeavoured to carry about with me instruments for instantly performing tracheotomy.

It consists of a medium-sized tracheal canula with a hollow pilot or key, which contains a scalpel. The shield is made of two pieces of stout wire, which, when the instrument is not in use, bend backwards against the sides of the tube. The whole instrument is so small and compact that it can be easily carried in the waistcoat pocket.

FIG. 106.—PILOT, SHOWING ITS HOLLOW CONSTRUCTION AND THE CONTAINED KNIFE.

*s*, slit, which opens to permit the removal of knife.

*Other Tracheotomy Instruments.*—For performing tracheotomy, a scalpel, a blunt-pointed bistoury, common dissecting forceps, a tenaculum, a pair of ordinary retractors, bone-cutting forceps, and elastic retractors are required. It is only the last-named instruments that demand a brief description; the various accessory appliances which may be necessary during the operation will be hereafter mentioned in speaking of the operation itself.

*Elastic Retractors.*—These consist of two pieces of silver wire formed like retractors, with shanks only an inch and a half long, connected together by a piece of elastic tape about ten inches in length. One retractor is first introduced into the side of the wound, the elastic is then passed round the neck, and the other retractor introduced. These retractors are useful when tracheotomy is performed for the removal of a foreign body, as an assistant holding the ordinary retractors is often in the way of the operator. They are employed in Germany in Bose's operation (p. 557).

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### ACCESSORY INSTRUMENTS USED IN CONNECTION WITH TRACHEAL CANULÆ.

*Trendelenburg's Tampon-canula.*—This is an instrument intended for blocking up the space between the canula and

the wall of the trachea, and thus preventing blood passing into the lungs in the case of operations on the larynx or pharynx, likely to be attended with serious hæmorrhage. The instrument was originally invented by Dr. Trendelenburg, but has since been improved by Drs. Semon[1] and Beschorner.[2] It consists of an ordinary tracheotomy tube with a broad groove running round its lower extremity externally. This groove receives a hollow india-rubber air-belt, which, when uninflated, is flush with the surface of the canula. A fine capillary silver tube, soldered *inside*[3] the canula, communicates at one end with the air-belt, and at the other opens near the anterior orifice of the canula. To this extremity is attached a piece of

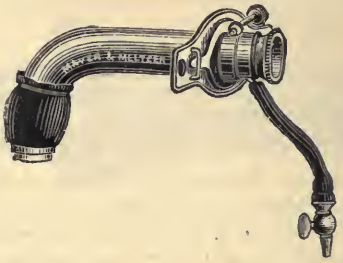

FIG. 107.—SEMON'S MODIFICATION OF TRENDELENBURG'S TAMPON-CANULA.

elastic tubing about six inches in length, with a stop-cock at its free end. The canula having been introduced into the trachea, the belt is inflated by means of the tube, and the stop-cock turned off. The expansion of the belt blocks up the space between the canula and the walls of the trachea, and thus renders it impossible for any blood to pass from the larynx into the air passages. It is very important not to fill the air-belt too full, as much pressure suddenly applied to the trachea is apt to produce an asthmatic paroxysm. I have seen this accident occur on two occasions.

*Tracheal Valves.*—In cases where the canula has to be worn for some months, the patient's comfort may sometimes

[1] "Monatsschrift für Ohrenheilkunde," &c. 1879, No. 6.

[2] "Deutsche Zeitschrift für Chirurgie." 1872, p. 466.

[3] In Trendelenburg's original instrument, the capillary tube was soldered to the *outside* of the canula, and rendered the latter very difficult of introduction. Dr. Semon's improvement consists in placing the fine tube within the canula.

be promoted by the application of a valve to its mouth, which admits the ingress of air, but closes the tube when the patient expires. The primary object of these valves is to enable the patient to speak without stopping the mouth of the canula with his finger, but they also greatly facilitate coughing and favour expectoration. Various kinds of valves have been devised. The first was that of Luer (Fig. 108), in which a small chamber containing a small ball is

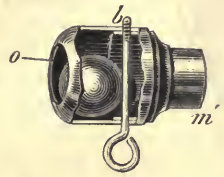


FIG. 108.—LUER'S VALVE, SEEN IN SECTION.

*o*, orifice; *m'*, mouth, which fits into *m* in Fig. 104; *b*, bolt, which prevents the small silver ball passing beyond the containing box.

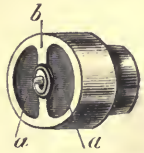


FIG. 109.—SMITH'S VALVE, SLIGHTLY MODIFIED.

*a*, india-rubber valves, which can be drawn in but not forced outwards; *b*, bar by which the valves are secured.

fitted into the mouth of the canula. When the patient speaks the pea is driven forwards and blocks up the anterior opening, whilst on inspiration it falls into the cavity of the containing box, and allows the air to enter the windpipe. The noise of the pea rattling in its chamber is annoying to some patients, and Mr. Thomas Smith[1] has invented a valve consisting of a little silver box with an india-rubber flap, permitting inspiration but closing the canula on expiration and vocalization. In this instrument the india-rubber valve is apt to be forcibly coughed out, and lately a somewhat similar valve (Fig. 109) has been made in which the flap is supported by a fine central bar which diminishes the tendency to its forcible eversion. It must not be forgotten

[1] "Trans. Med.-Chir. Soc." vol. xlviii.

that all these mechanical contrivances for assisting in speaking diminish the supply of air, and hence they should not be used during sleep or where any exertion has to be made.

*Artificial Vocal Apparatus.*—When the greater part of the larynx has been removed, vocalization can be assisted by the introduction of a vibrating-reed. The first instrument of this kind was devised by Gussenbauer,[1] but it has been considerably improved by Dr. Foulis.[2] It consists of two tubes, or, in other words, of the ordinary tracheal canula and an ascending branch. The latter is introduced first, and through its mouth the descending branch or ordinary canula is passed. Into a groove in the lower tube is slipped a reed, the vibrating edge of which is directed downwards in the long axis of the tube and reaches rather more than an inch from the external orifice of the instrument. The reed is free, and runs in a little groove in the side of the canula. Professor Heine has added a screw mechanism to the reed, so that it can be turned on one side when the patient is not speaking—an arrangement which permits a more abundant supply of air during ordinary respiration. In Gussenbauer's original instrument the descending portion was introduced first. This arrangement, however, was finally discarded, the subsequent introduction of the upper tube being found extremely difficult. It may be added that in the first instrument the reed was enclosed in a separate case.

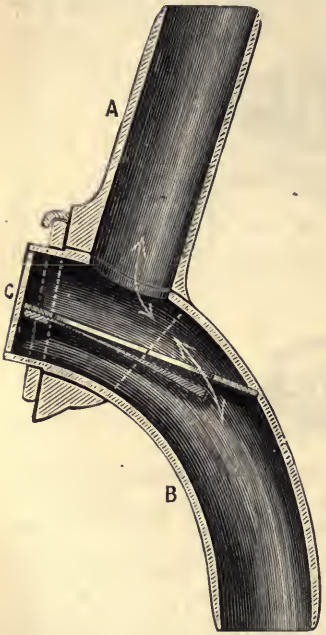


FIG. 110.—DR. FOULIS' MODIFICATION OF GUSSENBAUER'S VOCAL APPARATUS.

A, the upper tube; B, the lower tube; C, the reed.

[1] "Arch. Klin. Chir." 1874, bd. 17, p. 349.
[2] "Lancet," Jan. 26, 1878.

## ACUTE CATARRHAL TRACHEITIS.

*Latin Eq.*—Tracheitis acuta catarrhalis.
*French Eq.*—Trachéite catarrhale.
*German Eq.*—Akuter Trachealkatarrh.
*Italian Eq.*—Catarro acuto della trachea.

DEFINITION.—*Acute catarrhal inflammation of the lining membrane of the trachea, very seldom dangerous to life, characterized by cough and increased secretion of mucus, and commonly associated with a similar affection of the bronchi and larynx.*

*Etiology.*—Under this head it is only necessary to refer to the causes of the catarrhal laryngitis (page 265).

*Symptoms.*—The disease is generally very slight, except when the inflammation at the same time affects the larynx and bronchial tubes, under which circumstances the tracheal affection is apt to be overlooked. Cases, however, occasionally occur in which the inflammation is limited to the trachea, and it is then sometimes severe. In ordinary cases only a slight irritation, or a tickling sensation with a hacking cough, is experienced, but in a few cases I have observed a frequent violent and paroxysmal cough. Owing to the large calibre of the tracheal canal in relation to that of the larynx, considerable swelling of the mucous membrane may take place without giving rise to any dyspnœa. The expectoration is generally more abundant than when the larynx alone is affected, but much less copious than when the inflammation at the same time involves the bronchial tubes. On making a tracheoscopic examination the mucous membrane can be seen to be hyperæmic. Generally it is bright red, but occasionally it has a purple tinge; and in rare cases one or more ulcers may be perceived. When present they are usually situated on the inter-cartilaginous portions of the trachea; they are seldom larger than two millimetres in diameter, but I have once seen a catarrhal ulcer a centimetre in length and half that size in breadth. Patches of mucus are not infrequently seen adhering to the mucous membrane, and as they often remain in the same position for several days, they are apt to be mistaken for ulcers. With a firm short-haired brush, however, they can generally be dislodged. Twice I have known acute congestion of its lining membrane to be associated with *spasmodic*

*contraction of the trachea*,[1] but in what relation the two conditions stood to each other I am unable to state. In both cases the symptoms to some extent simulated asthma. One case is on record[2] in which acute laryngo-tracheal inflammation was followed by inflammatory thickening of the lining membrane of the trachea and by the formation of a plastic deposit which underwent some degree of development. "The structure was soft, tough, and fibrous, like pretty firm pleuritic adhesions." Tracheotomy was attempted, but owing to the density of the tracheal obstruction the canula could not be inserted until the excision was extended into the larynx. The patient died a few days afterwards from the *subsequent* supervention of diphtheria. The course of the tracheal affection from the time the symptoms commenced until diphtheria developed was only about thirty days. The original tracheal inflammation was preceded by an attack of measles, and was complicated by interstitial pneumonia.

When the laryngoscope cannot be used, information may sometimes be obtained by the stethoscope, mucous râles being often heard over the windpipe. Dr. Hyde Salter[3] formerly published some interesting papers to show that dysphagia is a symptom of tracheitis. He pointed out that whilst the lower extremity of the trachea is fixed, the upper extremity moves upwards with the larynx in swallowing, and hence, if the lining membrane of the tube is much inflamed, considerable pain is experienced in deglutition. It is characteristic of tracheal dysphagia, according to Dr. Salter, that the pain is most severe when the elevators of the larynx can act most vigorously in deglutition, that is, when the chin is raised, whereas if the chin is pressed against the neck so that these muscles cannot contract with force, little or no pain is experienced in swallowing. In the four cases brought

[1] Little is known of spasm of the trachea, which must be a very rare affection. Porter ("Surgical Pathology of the Larynx") cites an example from the "Edinburgh Medical Journal," in which, after death, an annular contraction of the central portion of the trachea was discovered. This contraction passed off on the following day. I have not, however, been able to find the case in the journal quoted by Porter. Dr. Scott Allison ("Morbid Conditions of the Throat and Consumption," 1867) has also described the condition, and Dr. Prosser James ("Sore Throat," 3rd edition, p. 260), to whom I am indebted for the above references, recognizes two forms of spasm, one allied to laryngismus stridulus and the other to asthma.

[2] Dr. Andrew Smith: "Amer. Journ. of Med. Sci." July, 1876.

[3] "Lancet," vol. ii. 1864, pp. 7 and 88.

forward in support of these views there were no symptoms of laryngeal inflammation, but, unfortunately, the laryngoscope was not used. Whilst attaching the greatest importance to the opinion of this excellent clinical observer, I think it right to state that although I have watched for this symptom I have never yet met with it.

*Diagnosis.*—In respiratory diseases, accompanied with cough and expectoration, the question whether the trachea is involved can only be determined with certainty by the aid of the laryngoscope.

*Prognosis.*—Simple inflammation, when limited to the mucous lining of the trachea, is almost devoid of gravity, and beyond the symptoms of cough and expectoration for a week or two no trouble need be apprehended.

*Treatment.*—The majority of cases of simple tracheitis scarcely call for any therapeutic measures. Confinement in a uniform temperature, a light diet, and gentle purgation, generally soon effect restoration. When the cough is troublesome, however, insufflations of morphia (gr. $\frac{1}{16}$ to gr. $\frac{1}{8}$), once or twice a day, are often of great service. If morphia disagrees, bismuth (gr. $\frac{1}{4}$ to $\frac{1}{8}$) with starch or gum (gr. $\frac{1}{2}$), administered by the same method, often gives relief. In order to hasten the cure a mixture containing some expectorant, such as squills or ipecacuanha, may be given, whilst sinapisms may at the same time be applied *not directly over the trachea* in the neck, but over the upper part of the sternum. Considerable benefit may also be derived from the employment of hot soothing inhalations (such as the vapor benzoini or the vapor lupuli of the Throat Hospital Pharmacopœia). Should the mucous secretion be too abundant it may be restrained by the use of stimulating inhalations of pine oil or creosote. After an attack of tracheitis the patient should of course observe more caution in returning to his usual avocations, and in cold and unsettled weather a respirator should always be worn by those who are subject to this affection. The prophylaxis recommended in laryngitis (page 272) is also sometimes required.

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## Chronic Tracheitis.

This affection occasionally remains as a sequel to the acute affection, and it is an almost invariable accompaniment of the chronic bronchitis of old people. In itself it does not

give rise to much inconvenience, nor is it attended with any serious danger. Balsamic inhalations generally give relief. In exceedingly rare cases thickening of the walls of the trachea may result from long-standing inflammation of a simple character; but in the whole range of medical literature, I only know of six cases in which this has occurred, viz., one reported by each of the following observers—Andral,[1] Gintrac,[2] Cyr,[3] Gibb,[4] and two by Wilks.[5] It is highly probable, moreover, that even in some of these cases syphilis was really the cause of the disease. The treatment for such cases is laid down under "Stricture of the Trachea."

## NON-MALIGNANT TUMOURS IN THE TRACHEA.

(Synonyms: Benign Growths. Polypi.)

*Latin Eq.*—Polypi tracheæ.
*French Eq.*—Polypes de la trachée.
*German Eq.*—Trachealpolypen.
*Italian Eq.*—Polypi della trachea.

Definition.—*Neoplasms of benign character forming projections on the mucous membrane of the trachea, and when large giving rise to severe dyspnœa.*

*Etiology.*—The etiology of tracheal polypi is similar to that described under the corresponding laryngeal affection (page 300), with the exception that the trachea, being much less liable to irritation than the larynx, is correspondingly less predisposed to the formation of growths. This will be readily understood when one considers that the trachea is a smooth canal whose functions are nearly passive, whereas the larynx, on the other hand, presents numerous irregularities and is composed of parts which are in constant movement. A few cases, however, of benign growths in the trachea

[1] "Clinique Méd." 1834, 3rd ed. t. iii. p. 183.
[2] "Bull. Méd. de Bordeaux." Juin, 1844.
[3] "Des Rétrécissements de la Trachée."—"Thèse de Paris," 1866.
[4] Op. cit. p. 391.
[5] "Guy's Hospital Reports." 1863.

have been recorded by Türck,[1] Gibb,[2] Fifield,[3] and Störk,[4] and I have myself met with four examples of the disease.

*Symptoms.*—The characteristic symptom of the disease is dyspnœa—its degree depending on the size of the growth and probably also on the rapidity of its development. In one of my cases the patient died from suffocation after refusing tracheotomy. In Türck's case of fibroma, however, the growth attained a very considerable size without giving rise to any serious dyspnœa; and the same remark applies to Schrötter's case of sarcoma (see page 530). In three of my cases the voice was hoarse or weak, but in one instance, though the neoplasm was large (Case 4), the voice was not at all affected. There is generally a good deal of irritation of the windpipe and some expectoration. With the laryngoscope the neoplasm can often be brought into view. Generalizing from my own few cases and the scanty records of others, the growths are usually of a papillary or cauliflower appearance; sometimes, however, they are smooth, and occasionally they have a semi-transparent aspect, as in Gibb's case. In some cases they are pedunculated, but generally they are sessile.

*Pathology.*—In three of my cases the rough, uneven surface of the growths led me to think that the tumours were papillomata; the remaining case had the appearance of a fibroma. Türck [5] described his case as a roundish hard fibroma growing from the posterior wall of the upper part of the trachea and reducing the canal to the shape of a crescent. At the corresponding situation, but extending backwards, was a smaller, more pedunculated, round tumour growing into the œsophagus. In Fifield's case, the growth, which was about the size of a small grape, was attached to the lower part of the trachea and covered the mouth of the left bronchus. It was described as "quite soft, of whitish colour, and of fleshy and probably fibrous character."

*Diagnosis.*—Tracheal polypi can only be diagnosed with certainty by means of the laryngoscope. In order to eliminate the chance of a syphilitic stricture, it is very important to ascertain the patient's history. Nor must the possibility of the existence of that very rare affection, cancer of the trachea,

[1] Op. cit. p. 502.
[2] Op. cit. p. 392.
[3] "Boston Med. and Surg. Journ." Nov. 14, 1861. Cited by Cohen, loc. cit. p 578.
[4] "Klinik der Krankheiten des Kehlkopfes," p. 438, et seq.
[5] Op. cit. p. 502.

be forgotten. The extension of cancer from the gullet to the trachea is easily recognized by the previous œsophageal symptoms. Türck's [1] case of fibroma, however, shows that there may be benign growths common to both the gullet and the trachea. Dr. Solis Cohen [2] points out that tumours in the sub-glottic region of the larynx are very apt to be mistaken for tracheal growths, and with this observation I entirely concur.

*Prognosis.*—Although the histories of the few cases of tracheal growth with which I am acquainted do not conclusively prove the statement, the prognosis must be regarded as unfavourable. In my four cases one patient, as already remarked, died from suffocation; two recovered under treatment, and one ceased attendance after an unsuccessful attempt to destroy the growth. In Dr. Fifield's case the patient died suddenly from suffocation; in each of Störk's three cases tracheotomy was recommended, but only one of the patients consented to it. In this case, which was complicated by an external tumour involving the right pneumogastric nerve, recurrence took place, tracheotomy was performed a second time, and a cure ultimately resulted, an anti-syphilitic treatment being carried out simultaneously with the operative procedure. In Störk's other two cases the patients probably died, unless tracheotomy was performed, and the same observation applies to my second case.

*Treatment.*—If the symptoms are not urgent, and the tumour is small and situated high up in the trachea, an attempt should be made to destroy it by electric cautery; but if the growth is large, or is situated low down, tracheotomy should be performed without delay. An extensive vertical incision should be made in the windpipe, the cut edges held well back, and the growth most carefully removed with cutting forceps or curved scissors. The base of the neoplasm should then be most thoroughly cauterized.

## SHORT ABSTRACTS OF ALL THE CASES OF TRACHEAL GROWTHS OBSERVED BY THE AUTHOR.

*Case* 1.—Henry L., aged forty-one, came under my care at the Hospital for Diseases of the Throat, March 2nd, 1865, suffering from hoarseness and slight dyspnœa. The larynx was congested, and the patient was treated with astringent solutions. On October 16th a growth, about the size of a bean, was seen occupying the second and third rings of the trachea anteriorly. In November several unsuc-

[1] Op. cit. [2] Op. cit. p. 576.

cessful attempts were made to seize the growth with tube-forceps, but on December 21, 1865, in the presence of Dr. Pratt, now of Paris, I succeeded in touching it with an electric-cautery point. The day afterwards a flat, black, eschar was all that remained of the growth, and a week later there were no signs of it.

*Case* 2.—Margaret C., aged twenty-two, applied at the Hospital for Diseases of the Throat in February, 1868, suffering from dyspnœa and weakness of voice. A growth about the size of a pea was seen on the third ring of the trachea, rather to the left side of the median line. An attempt was made to destroy it with electric cautery, but the patient moved, and both the vocal cords were slightly injured. The patient did not apply again.

*Case* 3.—Charles W., aged thirty-seven, a clerk, applied to me on March 6th, 1874, suffering from hoarseness and dyspnœa. A growth was seen just above the anterior commissure. This was removed with the lateral cutting forceps in five sittings. After the last operation a growth of about the size of a white currant was seen occupying the first and second rings of the trachea. The cricoid cartilage could be distinctly seen above the growth. After two failures, on November 11 I succeeded in touching the polypus with an electric cautery-point, and a week later there was not a vestige of the neoplasm. Mr. Poyntz Wright examined the case repeatedly with the laryngoscope both before and after the treatment.

*Case* 4.—Thomas C., aged forty-five, came under my care at the Hospital for Diseases of the Throat on June 15th, 1876, suffering from dyspnœa. A smooth, bright red polypus, about the size of a grape, was seen covering the fourth, fifth, and sixth rings of the trachea anteriorly, and blocking up the greater part of the tracheal lumen. Tracheotomy was proposed but refused, and the patient returned home. I subsequently learnt that he died suddenly, three months later, it was said, from apoplexy; but no post-mortem examination was made, and I feel convinced that the real cause of death was suffocation.

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## Osseous Growths.

In addition to the defined tumours already referred to, it is necessary to make a few remarks on the structural changes which the tracheal cartilages occasionally undergo. Rose [1] has called attention to the frequency of atrophy and fatty degeneration of the cartilages when pressed on by the enlarged thyroid gland, and after a certain age cretaceous changes may be looked upon as physiological products; but true bone is sometimes found replacing the cartilaginous rings or occurring between them. Some years ago Dr. Wilks [2] brought before the Pathological Society a specimen taken from the body of a phthisical patient, in which, beneath the mucous membrane on the anterior wall of the trachea, there was an immense

[1] "Der Kropftod," &c. Berlin, 1878.
[2] "Trans." 1857, vol. vii.

quantity of small bony lamellæ. These were situated between the rings of the trachea, and were not in direct connection with the cartilages. Microscopical examination showed a true bony structure. A similar deposit was found to a lesser extent beneath the mucous membrane of the bronchi. Dr. Chiari[1] showed a specimen of osteoma of the trachea at the Imperial Royal Medical Society of Vienna, May 24th, 1878. The growth consisted of a lamella of bone, four centimetres long and three centimetres wide, and from three to four millimetres in thickness. Some minute bony deposits were also found in the larger bronchi. The patient died of acute tuberculosis. Lastly, Dr. Solis Cohen[2] discovered in the trachea of a phthisical patient after death a considerable number of minute closely aggregated enchondromata, beneath the mucous membrane covering the anterior portions of the tracheal rings.

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### Post-Tracheotomic Vegetations.

Most surgeons who have had the opportunity of watching recent cases of tracheotomy must have noticed the tendency to the formation of "proud flesh" on the edges of the wound. This redundant development is especially likely to take place in cases where the wound is allowed to remain bathed in secretions, or indeed in a very moist condition. On temporarily removing the tracheal canula, these vegetations are often sucked into the wound, and if the tube is not quickly replaced the dyspnœa sometimes becomes very urgent. By touching the parts with solid nitrate of silver, and keeping the wound dry, the vegetations, as a rule, soon disappear. Cases, however, have occasionally been reported in which similar growths form on the tracheal mucous membrane *after the wound has cicatrized.* The first case of the kind was recorded by Dr. Gigon,[3] and subsequent examples have been reported by Krishaber,[4] Bouchut,[5] and others. Recently Dr. Petel[6] has collected and analysed all the cases hitherto placed on record, amounting to ten in number, and including one observed by Dr. Petel himself. The following are his most important

[1] "Lond. Med. Rec." July 15, 1878.
[2] "Diseases of the Throat," &c. Second Ed. p. 511.
[3] "Union Médicale," May 10, 1862.
[4] "Bull. de la Soc. de Chirurgie." 1874, p. 108.
[5] "Gazette des Hôpitaux," 24 Mars, 1874.
[6] "Des Polypes de la Trachée." Paris, 1879.

conclusions: The vegetations always grow from the mucous membrane covering the tracheal surface of the cicatrix; they are most frequently found in children of the male sex from fifteen days to a month after the wound has healed, and they never occur after two months have elapsed. As might be naturally expected, the occurrence of these vegetations is most to be feared in those cases in which the formation of "proud flesh" has been previously observed around the tracheal canula. The *symptoms* are those of embarrassed respiration, and may either partake of the character of progressive dyspnœa or sudden suffocation. The proper *treatment* consists in carefully dividing the cicatrix, removing the growth with cutting-forceps and cauterizing its base. Sometimes the polypus is difficult to find, and if a canula is inserted, it is likely to press it down and conceal it. It is necessary therefore to make a very careful examination, if the polypus does not at once present himself.

*Pathologically*, these vegetations, according to M. Ranvier,[1] "resemble those which develop round setons and drainage tubes," but he thinks it "possible that a papillary polypus, clothed with epithelium, may, under the influence of traumatic laryngitis, take on the character of proud flesh." Indeed, some of the observers who have reported examples of the affection are of opinion that these so-called "post-tracheotomic polypi" are in every case true tracheal polypi, which existed before the performance of the first operation, and led to it either directly or indirectly through the associated inflammation of the mucous membrane of the larynx and trachea. For although in most of the cases the operation was nominally performed on account of "croup," it must not be forgotten that in former years laryngeal growths were constantly mistaken for that affection, and such an error of diagnosis would be still more likely to ensue where the trachea was the seat of the disease. The balance of evidence is, however, very strong in favour of the post-tracheotomic theory—the fact that the growth is always situated on the cicatrix being to my mind conclusive.

[1] "Bull. de la Soc. de Chir." 1874, p. 108.

## [MALIGNANT TUMOURS OF THE TRACHEA.

Under this head are included (1) Carcinomata, (2) Sarcomata.]

## CANCER OF THE TRACHEA.

*Latin Eq.*—Carcinoma tracheæ.
*French Eq.*—Cancer de la trachée.
*German Eq.*—Krebs der Trachea.
*Italian Eq.*—Cancro della trachea.

DEFINITION.—*Primary cancer of the trachea giving rise to dyspnœa and, if not relieved by surgical treatment, to fatal apnœa.*

This disease is so rare that it does not require to be treated with the same detail as most of the other tracheal diseases. The *origin* of cancer is probably always to be found in an abnormal formative property with which the tissues are primarily endowed, but it would appear that the perverted energy is, as a rule, only called forth by some local irritation. The remarkable relative immunity which the trachea enjoys may be explained by its freedom from functional excess and accidental injury. The principal *symptom* of the affection is tracheal stenosis, but an accurate *diagnosis* can only be made with the aid of the laryngoscope. As regards *pathology*, of the only two cases with which I am acquainted, one was described as a soft cancer, and the other was an example of epithelioma.

In the case reported by Langhans[1]—the only example hitherto published—the patient was a man aged forty, who suffered for one year from symptoms of stenosis of the bronchi—especially of the right bronchus—and died from suffocation. The post-mortem examination revealed carcinomatous degeneration of the mucous membrane of the trachea above the bifurcation, and of the bronchi just below that spot. The microscope showed that the neoplasm was a soft carcinoma, which took its origin in the glandulæ of the mucous membrane. There was no disease of any other organ. The *prognosis*, it need scarcely be said, is most unfavourable, the patient being unlikely to live more than a year or two at the most.

*Treatment.*—Soothing inhalations and sedative medicine

[1] Virchow's "Archiv," liii. p. 470.

may be administered, and when the growth is high in the trachea tracheotomy may be performed with advantage. Extirpation of the trachea with a view of eradicating the morbid growth will probably be attempted in future cases.

### CASE OF CANCER OF THE TRACHEA.

Jane E., aged fifty-seven, an unmarried woman who "was formerly gay, and had had the bad disease," came under my care at the Hospital for Diseases of the Throat in April, 1864, suffering from shortness of breath, which had lasted for six months. *Diagnosis:* Tracheal stenosis, probably syphilitic, but no evidence of constitutional syphilis; congestion of larynx, but no narrowing. Dysphagia subsequently came on, and the patient died in January, 1865. On post-mortem examination an ulcerated growth was discovered occupying the middle third of the trachea, and originating from three sides of the tube; the largest portion of the base of the growth, however, was on the posterior wall, which was thickened and projected backwards into the œsophagus. The lining membrane of the œsophagus was perfectly smooth, and the vertical extent of the projection into its canal was only a centimetre. The trachea, on the other hand, was contracted at its narrowest part to such an extent that a probe four millimetres in diameter could only be passed with difficulty. The growth extended to within half an inch of the cricoid cartilage above. A portion of the morbid structure was examined by Dr. Andrew Clark, and pronounced to be "typical epithelial cancer," containing numerous nested-cells. The tissues around the trachea were slightly thickened, and two of the bronchial glands were somewhat enlarged.

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### Cancer from Contiguity.

Secondary cancer of the trachea, in the true sense of the word, is, I believe, unknown; but cancer due to contiguity, that is to say, to the extension of the disease from the neighbouring parts, is by no means rare. It is from the œsophagus that the disease generally spreads, a large number of cases of malignant disease of the gullet ultimately involving the trachea. Sometimes there is merely an infiltration of the posterior wall, but not unfrequently the growth sprouts into the tracheal canal, and a fistulous communication is often established between the two tubes. Extension of malignant disease also sometimes takes place from the thyroid gland, and occasionally a mediastinal tumour penetrates the trachea. In the œsophageal cases the occurrence of dyspnœa, where previously dysphagia alone existed, at once points to the nature of the affection; but it is sometimes difficult to determine whether the symptoms are caused by compression from an external tumour, or its penetration into the windpipe. The fœtid odour which is generally perceived when a cancer

opens into the trachea usually at once proclaims the fact; in some cases, moreover, cancerous matter can be discovered with the microscope in the expectoration. In contiguous cancer it is seldom desirable to attempt to prolong life by the performance of tracheotomy.

### Sarcoma of the Trachea.

Two cases of sarcoma have been reported by Professor Schrötter.[1] One was that of a man, aged thirty-four, who suffered from a smooth lobular pedunculated tumour, reaching up to a level with the fourth tracheal cartilage, and apparently covering two or three of the cartilages immediately below. After removing some portions of the growth with the tube-forceps, Schrötter injected the remainder with a strong solution of perchloride of iron, which resulted in wasting of the neoplasm so that only a small stump remained. Recurrence, however, soon took place, and portions have from time to time been since removed with forceps. When last heard of, tracheotomy was imminent. The second case referred to above passed out of Schrötter's hands, and came a few years later under the care of a young physician, who attempted to carry out the treatment by means of injection which had proved so successful in Schrötter's hands. Unfortunately, however, spasm of the glottis supervened, and the patient died before tracheotomy could be performed. Whilst admiring Professor Schrötter's skill, I cannot refrain from expressing my opinion that the treatment by injection of perchloride of iron is as hazardous as it is difficult; the preferable mode of treatment in such cases has been already laid down (see page 524).

## SYPHILIS OF THE TRACHEA.

*Latin Eq.*—Syphilis tracheæ.
*French Eq.*—Syphilis de la trachée.
*German Eq.*—Syphilis der Trachea.
*Italian Eq.*—Sifilitide della trachea.

Definition.—*Syphilis attacking the trachea and giving rise to the various pathological changes which are met with in the secondary and tertiary stages of that disease when affecting mucous membranes.*

[1] "Jahresbericht der Klinik für Laryngoscopie." 1871, p. 80, et seq., and "Laryngolog-Mittheilungen." 1875, p. 102.

*Etiology.*—The determination of disease to the trachea in syphilitic persons is probably due to some accidental congestion or old-standing relaxation of the mucous membrane of the part. According to my experience the affection is rare, only three cases, all of them tertiary, having been met with amongst 1,145 patients suffering from syphilis of the pharynx, larynx, and trachea (see page 353). Nevertheless, as attention has been directed to the subject for many years, the literature is pretty extensive (see page 533). Most of the cases I have met with have occurred between the ages of twenty-five and forty; whilst in twenty-two cases collected by Gerhardt[1] there was only one in the first decennium. Hüttenbrenner[2] has, however, recorded a case in a girl twelve years old, and Woronichin[3] has reported an example of syphilitic ulceration of the posterior wall of the trachea, close to the right bronchus, in a child fourteen months old. Examples of hereditary syphilis occurring in infants will no doubt be met with if sought for in the children's hospitals and workhouse infirmaries.

*Symptoms.*—The subjective symptoms being very slight, the early phenomena can only be discovered with the aid of the laryngoscope. At the inception there may be only obstinate congestion, but occasionally condylomata are met with. The latter condition is, however, very rare. I have myself observed it in only five cases, and Seidel[4] has reported one instance. Superficial ulcers are also occasionally seen. The characteristic tracheal condition, however, of syphilis is the narrowing of the tube which occurs in the later stages, and which will be fully described in the next article.

*Diagnosis.*—The diagnosis of the affection can generally be made out by the history of the case, the use of the laryngoscope, and the exclusion of diseases likely to produce compression.

*Prognosis.*—Even in slight cases the occurrence of syphilis in the trachea must be looked upon as a serious affection. Indeed, the mildest secondary phenomena indicate that the trachea is predisposed to the affection, and that the patient is not unlikely to suffer from those later manifestations which are amongst the most fatal consequences of the syphilitic poison.

*Pathology.*—It is only the pathological changes met with in tertiary syphilis which need be seriously considered. It is

[1] D. Archiv f. Klin. Med. Bd. ii.
[2] "Jahrbuch für Kinderkrankheiten." 1872, vol. v.
[3] Ibid. 1875, vol. viii. [4] "Jen. Zeitschr. f. Med." Bd. iii.

probable that most cases of important structural change in the trachea as the result of syphilis commence with gummatous deposits in the sub-mucous tissue. These deposits soften and give rise to ulcers which, under suitable treatment, heal, and in process of cicatrization form a dense tissue which greatly narrows the canal. It is true, as Lancereaux[1] has pointed out, that these changes cannot always be discovered, but from the fact that the various stages are sometimes present in different parts of the trachea in the same case,[2] it is presumable that the sequence of morbid development is such as has been described. Great cicatricial narrowing of the tracheal canal is the most characteristic condition. In a case reported in the next article, the widest diameter of the constricted portion of the trachea was only one-eighth of an inch. There is often dilatation of the canal both above and below the seat of the stricture. The walls of the trachea are ultimately converted into a dense fibrous tissue, and this change generally affects their entire thickness, and extends over a very large superficial area of the canal. Small ulcers and projecting ridges are frequently seen, but occasionally the ulcers are of a very considerable size, and in some cases the disease involves portions of the cartilaginous rings which are either denuded and necrosed, or have been absorbed[3] or expectorated. Not only is the lumen of the trachea diminished, but the actual length of the tube is sometimes reduced, and one case[4] is on record in which a fistulous communication took place between it and the œsophagus. The seat of the disease is most frequently the lower part of the trachea.

*Treatment.*—The early manifestations, as a rule, soon disappear, but the tertiary phenomena generally resist treatment altogether, or are only temporarily relieved. As the patient is generally much broken down in health, iodide of potassium in small doses should be tried at the outset, and if the remedy agrees, the dose should be quickly increased, ten, twenty, or even thirty grains being given three times a day. If this treatment does not afford relief after a week or two, the patient should be rapidly brought under the influence of mercury. In these cases it is no use giving the per-salts in

[1] "Treatise on Syphilis"—"New Syd. Soc. Trans." 1869, vol. ii.
[2] Moissenet: "Union Médicale." 1864, nouv. série, f. xxi. p. 340.
[3] An excellent illustration of this absorption has been recorded by Worthington: "Med.-Chir. Trans." 1842, vol. xxv.
[4] Beger: "Deutsches Archiv für Klin. Med." May 15th, 1879.

small doses for a long time, but either inunction, subcutaneous injection, or some quickly acting form of mercury should be employed. In one case in which three grains of grey powder were given with two grains of henbane three times a day, slight ptyalism was produced after twenty grains had been taken, and two days later the dyspnœa completely passed off. In another case excellent results were produced by the same remedy after it had been administered for five days. In both these cases, however, relapse took place after a few weeks. If the therapeutical measures already detailed do not give relief, tracheotomy must be performed when there is a possibility of getting below the seat of obstruction. The circumstances which govern the performance of the operation will be referred to in the next article.

## STRICTURE OF THE TRACHEA.

*Latin Eq.*—Strictura tracheæ.
*French Eq.*—Rétrécissement de la trachée.
*German Eq.*—Verengerung der Trachea.
*Italian Eq.*—Ristringimento della trachea.

DEFINITION. — *Narrowing of the tracheal canal from thickening of the walls of the tube.*

*History.*—Stenosis of the trachea was referred to by Heister,[1] Albers,[2] and others, but the subject was first treated in a thoroughly systematic manner by Dèmme.[3] Since that time a large number of isolated cases have been published, and the subject has been handled in a most philosophical way by Gerhardt,[4] whilst a complete bibliography and very comprehensive article have been published by Riegel.[5]

*Etiology.*—Tertiary syphilis is almost invariably the cause of tracheal stricture, but it is occasionally produced by other diseases, such as cancer, benign growths, and chronic tracheitis. There are only two cases of primary cancer on record (pp. 528, 529), but not infrequently a malignant growth penetrates from the œsophagus to the trachea. In these cases,

[1] "Med. Chirurgische Wahrnehmungen," No. 297, p. 843.
[2] "Atlas der Pathol. Anat." ii. p. 136.
[3] "Ueber Stenose der Trachea"—"Würzburg Med. Zeitschrift," Bd. ii.
[4] "Ueber Syph. Erkrank."—"Deutsches Archiv f. Klin. Med." Bd. ii. p. 535.
[5] Ziemssen's "Cyclopædia," vol. iv. p. 470.

however, death generally takes place so rapidly from perforation of the posterior wall of the trachea, that the subject need not be considered here. On the other hand, benign growths of a defined character are so extremely rare that nothing need be here added to what has been stated of them under their proper heading.

*Symptoms.*—Patients affected with tracheal stricture are generally feeble, anæmic, and emaciated, and on careful examination usually show some evidences of constitutional syphilis. The most marked symptom of the affection is dyspnœa. This symptom varies in intensity according to the degree in which the tracheal canal is narrowed, and is, as a rule, greater during inspiration than expiration. It is, however, subject to considerable variation according to the extent and situation of the stricture. When the disease is only in its earliest stage, valuable information may sometimes be obtained by employing Waldenburg's[1] system of pneumatometry or Riegel's[2] graphic method of investigation. Tracheal dyspnœa, as Gerhardt[3] first pointed out, is characterized by an absence of movement on the part of the larynx, whilst in laryngeal obstruction the larynx falls and rises with great energy in each act of respiration. There is often considerable stridor, but the sound has never the metallic ring of laryngeal obstruction. Gerhardt has also observed that in severe tracheal dyspnœa the head, instead of being thrown back, as it is in cases of laryngeal obstruction, is either kept in the ordinary position or bent forward. The stethoscope yields only negative signs, the vesicular murmur being overpowered by the tracheal noise, which is generally more audible over the larynx than over the seat of stricture. In cases of long standing stricture, the circumference of the thorax is stated by Demme[4] to be contracted, especially in the upper part. The voice is feeble but clear. With the laryngoscope the contraction can often be seen. It frequently has the appearance of a number of concentric rings diminishing in size from above downwards (see Fig. 111), and terminating in a small round or oval opening. It is exceedingly difficult to determine the exact level of the stricture, the usual landmarks which in health furnish the perspective below the vocal cords being wanting. If not relieved by medical treatment

[1] "Die pneumatische Behandlung." Berlin, 1875.
[2] "Athembewegungen." Würzburg, 1873.
[3] "Lehrbuch der Auscultation," &c. Tübingen, 1871.
[4] Op. cit.

or a surgical operation, these cases almost invariably terminate fatally. As a rule, death takes place from coma following on pneumonia or œdema of the lungs, but sometimes the patient dies from apnœa due to a sudden attack of spasm of the trachea.

*Pathology.*—The pathology of this affection must be sought for under the various diseases which give rise to stenosis, such as syphilis, cancer, benign growths of trachea, and tracheitis. It must be borne in mind, however, that the malady which gives rise to stricture is almost always syphilitic. The stricture is generally situated at the lower part of the trachea, but occasionally it occurs quite at the commencement of the tube; the middle third is most rarely attacked. Sometimes, however, the whole length of the trachea is diseased, and its lumen throughout greatly diminished.

*Diagnosis.*—When once an example of tracheal stenosis has been met with, there will, as a rule, be no difficulty in recognizing subsequent cases, and I have known a hospital nurse, after her first experience, at once diagnose the affection. It is the character of the breathing and a peculiar noise made in inspiration which distinguish the condition. It is extremely difficult, however, to differentiate a *stricture* from *compression* of the trachea. Tracheoscopy may settle the question, and in some cases the existence of disease of the thyroid body or cervical glands, a mediastinal tumour, or an aneurism of the aorta, may point to an external cause of pressure. Again the same condition which gives rise to compression of the trachea, may also cause pressure on one of the recurrent nerves, and thus lead to paralysis of one of the vocal cords. This is a point worthy of consideration when the evidence of compression is very slight. The difference between laryngeal and tracheal dyspnœa has been referred to under "symptoms;" *bronchial* stenosis, when due to plugging of only one of the primary bronchi, may be recognized by the absence of breath-sounds in the corresponding lung, which, at the same time, retains its resonance on percussion. When, however, both bronchi are pressed upon, it is almost impossible to distinguish the affection from tracheal stenosis. The impaction of a foreign body in the trachea may give rise to difficulty in diagnosis, but from the history of the case and the sudden supervention of the symptoms there is generally little difficulty on that score. A case, however, has been recorded by

Stokes[1] in which a stricture was suspected until tracheotomy was performed, when a pultaceous fœtid mass of decomposing cheese was expelled, to the instant relief of all the symptoms.

*Treatment.*—If the symptoms are not very urgent, the therapeutical measures described in the last article should be attempted; but it must be remembered that stricture of the trachea is, as a rule, of a cicatricial character, and that therapeutic efforts are likely to prove in vain. Soothing inhalations, however, such as hop and benzoin, sometimes relieve spasm and diminish irritation. If the symptoms are very urgent and the stricture is situated in the upper or middle third of the windpipe, tracheotomy should be performed, but if the stenosis is lower down, the operation is of no avail and should on no account be carried out. Unfortunately, it cannot always be determined how low a stricture extends; for though its upper limit may be seen with the laryngoscope to be close to the larynx, the cicatricial tissue may pervade the whole length of the trachea, and, as in the following case, an operation which promises success may prove perfectly futile:—

Robert Collins, aged thirty-one, an engraver, was admitted into the Hospital for Diseases of the Throat on account of great dyspnœa, January 7th, 1870 An examination with the laryngoscope was made with great difficulty, owing to the patient being very nervous, but ultimately the larynx was found to be perfectly healthy. On inspecting the trachea, however, the canal was seen to be narrowed by a kind of web, which was attached round the edges of the trachea,

Fig. 111.—Concentric Stricture of the Trachea.

leaving only a narrow opening, the widest diameter of which seemed less than six millimetres. The exact situation of the web, that is to say, its distance below the vocal cords, could not be ascertained, as the patient could only bear a very rapid examination. His friends stated that he had been short of breath for two years, and that on several occasions recently he had fallen down insensible. On his

[1] "Diseases of the Lungs and Windpipe." Dublin, 1837.

way to the hospital he had walked very slowly, and had been compelled to stop two or three times for want of breath. Tracheotomy was performed with some difficulty, owing to considerable fibrous enlargement of the thyroid gland especially affecting its isthmus. The patient was very little relieved by the operation and died sixteen hours after it. On post-mortem examination a stricture of the trachea was found, which commenced an inch and three-quarters below the vocal cords, and extended downwards for rather more than an inch; at its narrowest part the diameter of the canal measured only three millimetres. The lower edge of the stricture was formed by a white cicatricial ridge, and from it there radiated downwards several similar eminences. There was also a large flat depressed scar below the stricture.

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### Compression of the Trachea.

The most common *cause* of this condition is enlargement of the thyroid gland, but it is not unfrequently occasioned by aneurism of the aorta. More rarely disease of the cervical glands,[1] or general lymphoma of the neck, gives rise to it, and still less frequently it is caused by mediastinal tumours. The *symptoms* are precisely the same as those referred to under the head of "stricture," and the *diagnosis* between the two affections can often only be arrived at by careful tracheoscopic examination. There is little to be said on the subject of the *pathology* of compression, but it may be remarked that the pressure often actually gives rise to disease of the structures constituting the walls of the trachea. In advanced cases there is hypertrophy of the glandulæ and of the areolar tissue. The mucous membrane is thrown into irregular ridges and the cartilaginous structures are diminished in volume, and in some places completely absorbed. The *prognosis* varies according to the exact site of the narrowing, being, of course, less favourable when the pressure is on the lower part of the trachea. The only *treatment* of any avail consists in the removal of the tumour causing compression, or, if this cannot be accomplished, in the performance of tracheotomy, and the employment of König's long flexible canula (page 514).

[1] An interesting case has been recorded by Rush: "Medical Observations and Enquiries of a Society of Physicians," vol v. p. 96, in which a tumour (probably an enlarged gland) about the size of an English walnut, containing an offensive material, caused compression of the trachea. See also the cases referred to in Note 1, p. 564.

## TRACHEAL PHTHISIS.

*Latin Eq.*—Phthisis trachealis.
*French Eq.*—Phthisie trachéale.
*German Eq.*—Trachealschwindsucht.
*Italian Eq.*—Tisi della trachea.

DEFINITION.—*A chronic affection of the trachea characterized by tumefaction and ulceration of the softer structures and sometimes by exposure and destruction of the cartilages, arising from a local deposit of tubercle, which is probably always preceded by a similar disease of the lungs.*

*Etiology.*—The previous existence of pulmonary phthisis must be regarded as the exciting cause of the tracheal affection, but the manner in which it operates is unknown. Hitherto the affection has received but little attention, though a few cases have been reported by Louis,[1] Wilks,[2] and others. The comparative unimportance of the affection is probably the reason why it has attracted so little attention, for it is by no means uncommon. Thus, out of 1,236 cases of pulmonary phthisis occurring at the Pathological Institute of the University of Leipzig[3] there were 99 cases of ulceration of the trachea, in 80 of which the larynx was at the same time affected. In 100 autopsies of laryngeal phthisis I found 27 examples of ulceration of the trachea, which gives a rather larger proportion. Of these 27, 17 were males and 10 females. In 13 cases of tracheal phthisis (uncomplicated by a laryngeal affection) 9 were males and 4 females. All the cases occurred between the ages of 24 and 47. With regard to the general etiology of the subject, the reader is referred to the causes of laryngeal phthisis (page 368).

*Symptoms.*—The phenomena due to the tracheal affection are generally masked by the more objective symptoms of the co-existent pulmonary and laryngeal diseases, and it is only occasionally that the tracheal affection is noticed during life. Anæmia of the mucous membrane, which has been observed as a precursor of laryngeal phthisis (see page 372), may sometimes be noticed in the trachea. As the disease progresses

[1] "Researches on Phthisis"—"Syd. Soc. Trans." by Dr. Walshe. 1844, pp. 263, 268.
[2] "Guy's Hospital Reports," vol. xv. p 8.
[3] Heinze: Op. cit.

ulcers can be seen on the anterior wall of the tube. In the early stages there is nothing, except their intractability, to distinguish these ulcers from those which are due to catarrh, but in severe cases the denudation of the cartilages and their necrotic appearance is characteristic. In two cases (uncomplicated by laryngeal phthisis) which have come under my notice, inspiratory dyspnœa was a marked symptom. There is, generally, a considerable amount of expectoration and cough; but in the presence of the pulmonary affection, it is not possible to tell how far these symptoms depend on the condition of the trachea.

*Pathology.*—The histological changes which take place in tracheal phthisis are, probably, similar to those which have been described in connection with the laryngeal affection (see page 377). The ulcers vary in size and depth, being generally of round or oval shape, and measuring from a millimetre to a centimetre in diameter, the most common size being from two to four millimetres. They are far more common on the posterior wall than at any other part, and more numerous at the lower than the upper portion of the trachea.

*Diagnosis.*—The existence of the disease can only be arrived at during life with approximate certainty, by discovering evidences of pulmonary phthisis; but even under these circumstances, it must not be forgotten that catarrhal ulceration of the trachea may co-exist with true pulmonary phthisis. The possibility of the simultaneous occurrence of a syphilitic stricture of the trachea and a deposit of tubercles in the lungs must also be borne in mind.

*Prognosis.*—Except in those cases where the disease leads to destruction of the cartilages, it, probably, but little affects the issue of the complaint. Of course, however, where the cartilages are exposed and project into the trachea, some stenosis may result, and the fatal termination be hastened.

*Treatment.*—Soothing inhalations and sedative insufflations are sometimes required, but, as a rule, the disease calls for little interference. In those rare cases, however, in which the affection causes narrowing of the upper part of the tracheal canal, tracheotomy may prolong a miserable existence for a few weeks or months.

## WOUNDS OF THE TRACHEA.

*Latin Eq.*—Vulnera tracheæ.
*French Eq.*—Plaies de la trachée.
*German Eq.*—Wunden der Trachea.
*Italian Eq.*—Ferite della trachea.

DEFINITION.—*Wounds of the trachea of an incised, punctured, or contused character, with or without wound of the integument, generally giving rise to subcutaneous emphysema and considerable dyspnœa.*

*Etiology.* — Incised wounds are generally of a suicidal origin, whilst those of a punctured character may be inflicted by sword[1] or bayonet, or indeed by any sharp instrument.[2] Contused wounds are rare, and are usually complicated by great injury of the larynx; the cartilages of the windpipe are often crushed, and the accident is generally described as *fracture of the tracheal cartilages.* Gurlt[3] has collected nine examples, in four of which the trachea alone was damaged. When the tracheal rings are torn apart, or the trachea is detached from the cricoid cartilage, the accident is usually reported as *rupture of the trachea.* It will be easily understood that these severe injuries may occur in many different ways. Sometimes they result from the kicks[4] of horses or men. Atlee[5] has reported a case in which a boy fell

[1] Ambroise Paré: "Œuvres Complètes," par Malgaigne, 4 liv. 8, chap. xxx.

[2] Atlee: "Amer. Journ. Med. Sci." 1878, p. 433; a case in which a boy punctured his trachea with the point of closed scissors; emphysema ensued, but the child recovered.

[3] "Handbuch der Knochenbrüche," p. 316, et seq. In injecting bronchocele, I have, on three occasions, penetrated the trachea. This accident is, however, excessively rare, as I must have injected bronchoceles at least 5,000 times. On two occasions no inconvenience resulted, the patient merely expectorating a little iodine, but in a third case, in which an exploratory trochar was used on a boy twelve years of age, persistent hæmoptysis instantly arose. An attempt was made to arrest the hæmorrhage by the inhalation of a tannic acid spray, but it produced no effect. About a quarter of an hour from the time of the accident I injected a few drops of perchloride of iron through the small opening in the thyroid gland, and the bleeding was immediately arrested. It is worthy of remark that no hæmorrhage took place externally.

[4] O'Brien: "Edin. Med. and Surg. Journ." vol. xviii. Robertson: "Lancet," September 6, 1856. Hunt: "Amer. Journ. Med. Sci." April, 1836, p. 378.

[5] "Amer. Journ. Med. Sci." January, 1858.

on a kerbstone, striking his neck against a scraper; and Drummond[1] has related an instance in which an aged woman fell forwards and struck her neck against one of the upright spindles of the back of a chair from which the top transverse rail was missing. In the case of a man recently sent to me by Mr. Stretton, of Kidderminster, the left side of the trachea opposite the fourth and fifth rings was forced slightly inwards, and the inferior cornu of the thyroid cartilage dislocated forwards by a trivial accidental blow with the side of the unclosed hand. In a case[2] recorded by Long the patient was caught between two railway buffers. Professor Gross[3] has reported a case in which rupture of the trachea resulted from violent inspiratory efforts to relieve the dyspnœa caused by the pressure of a large thoracic aneurism, and Gurlt[4] mentions another in which a similar accident occurred to an infant under two years of age who kept tossing his head violently about during an attack of bronchitis.

*Symptoms.*—The symptoms vary according to the nature and intensity of the injury. Dyspnœa is the most common phenomenon, but there is frequently spitting of blood, and extensive emphysema of the areolar tissue is also very often present. Ambrose Paré described a case in which "the wind went forth from the wound over the whole body, so that the patient could not articulate in the least." There is often abrasion of the surface of the neck, and not unfrequently the larynx is injured. Occasionally the trachea is torn through transversely. These cases generally terminate fatally, but Long's patient recovered.[5]

*Diagnosis.*—An accident being known to have occurred, there can be little difficulty in arriving at the diagnosis. Accurate information will, no doubt, in future cases, be sometimes obtained with the aid of the laryngoscope, but, as a rule, the external contusion and other symptoms render the diagnosis very easy.

*Prognosis.*—The prospect of the patient depends on the nature of the injury and on the complications which may be present. Extensive contusions add greatly to the risk of a wound in the trachea. On the other hand, punctured and incised wounds often do well.

[1] "Brit. Med. Journ." December 28, 1872.
[2] "Med. Times," May 10, 1856.
[3] "Pathological Anatomy." Third edition, 1857, p. 404.
[4] Op. cit.
[5] Op. cit.

*Pathology.*—The pathology of the disease depends on the amount and kind of injury which has been inflicted.

*Treatment.*—In injuries accompanied with much contusion tracheotomy is almost always necessary. Even if not urgently called for, it can add little to the risk of the patient, and may be the means of warding off the danger of a sudden access of spasm. In very slight wounds, where it is thought tracheotomy may be omitted without risk, the patient should be kept in bed in a state of *absolute quietude*, especially in the case of children, for it must not be forgotten that the least struggle, such as might occur in giving medicine, may convert a slight wound into an extensive rupture, and thus bring about fatal results.[1]

Suicidal wounds of the trachea will be considered in the article on "Cut Throat"—(Vol. II.).

[1] See Atlee's first case.

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## BRONCHOTOMY, INCLUDING TRACHEOTOMY AND (CRICO-THYROID) LARYNGOTOMY.

The older physicians used the word "Bronchotomy" as a general term for the various operations by which the air passages are laid open, and under this head may be included thyrotomy (*i.e.*, laryngotomy, by median section of the thyroid cartilage), laryngotomy, as the term is understood in this country (*i.e.*, an opening through the crico-thyroid membrane), tracheotomy, in which the trachea is opened, and laryngo-tracheotomy, in which both larynx and trachea are cut into—an operation seldom performed. The subject of thyrotomy has been considered in discussing the treatment of laryngeal growths (page 324) and the other operations will be presently described. In dealing with the history of laryngo-tracheal operations, it would be inadvisable to separate them, whilst the preparatory stages and subsequent precautions are nearly the same in all cases. Hence it is convenient to consider under the ancient term of "Bronchotomy," the history of the operation, the indications for its performance, the use of anæsthetics, the various accessory appliances required in connection with the operation, the duties of assistants, the position of the patient and that of the operator, and the after-treatment.

*History.*[1]—Tracheotomy dates from about 100 B.C., and Galen[2] states that Asclepiades, of Bithynia, was the first to perform it.

[1] In dealing with this subject, I have made considerable use of Sprengel's "Geschichte der Chirurgie." Halle, 1805, but I have traced a large number of Sprengel's references to their original sources, and I find that many of them do not correspond with those given by that author. I have also omitted some of Sprengel's authorities on account of their comparative unimportance, and added the names of several which had escaped his notice.

[2] "Opera Omnia quæ extant"—"De Bronchotomia." Venetiis, 1562.

Aretæus,[1] in the first century, condemned the operation on the ground that wounds of cartilages cannot heal; and Cœlius Aurelianus,[2] nearly three hundred years later, agreed with Aretæus. Paulus Œgineta,[3] who lived in the seventh century, seems to have repeatedly opened the windpipe, and he also states that Antyllus, of Rome, (A.D. 340), made a transverse incision into the trachea between its third and fourth rings, and drew the cartilages apart with hooks; as soon as the patient breathed more freely, he sewed the edges of the wound together again. The Arabians were never great as surgeons, and we find that tracheotomy was referred to by Abu 'l Kasem[4] and Ebn Zohr[5] only as a possibility. Science, like literature and art, was soon overwhelmed by the barbarism of the dark ages, and it was not until the revival of learning in the fourteenth century that we again hear of the operation of tracheotomy. At that time Guido de Cauliaco[6] attempted to introduce it. In the first half of the sixteenth century, a Florentine physician, Benivieni,[7] performed it successfully, and it was undertaken about this time both by Gulielmo de Saliceto[8] in a case of angina, and by Rolandi,[9] a Bolognese professor, to relieve stenosis produced by a laryngeal abscess. In 1546 Musa Brassarolo,[10] of Ferrara, performed the operation successfully, and fifty years later Sanatorius[11] for the first time used a trochar, and left a canula three days in the wound. Ambroise Paré[12] opened the trachea by means of a transverse incision in a case of angina, but he was opposed to a division of the rings of the trachea themselves. An important improvement was made somewhat later in this century by Fabricius ab Aquapendente,[13] who operated successfully in cases where foreign bodies were impacted in the larynx, and "when that tube was clogged with viscid mucus." He made a vertical incision through the tissues, and in order to avoid the danger of the tube falling down the windpipe, introduced a canula with wings. His pupil, Casserius,[14] made a very important improvement in introducing a canula with a curve corresponding to the arc of a quadrant, and he also tied the canula in position with tapes. The improvement in the shape of the instrument, however, was soon lost sight of, and the straight tube long remained in use. In the early part of the seventeenth century Habicot,[15] of Paris, performed tracheotomy with considerable success in inflammation of the larynx, and in Naples, Severinus[16] opened the trachea in a severe case of mumps; shortly afterwards Renatus Moreau[17] performed the operation under similar circumstances. Various suggestions were made by

[1] "De Cur. Acut. Morb." i. i. c. 7.
[2] "De Morb. Acut." liii. c. 4.
[3] "De re Medicâ Opus; Operationes." Paris, 1532.
[4] "Chirurg." lib. ii. f. 43, p. 227.
[5] "Theisir," lib. i. c. 14, f. 15d.
[6] Mingetonsault: "La grande Chirurgie." Paris, 1683
[7] "De Abditis Morborum ac Sanationum causis, cum Galeni," &c. Basil, 1528.
[8] Linhart: "Compend. der chir. Operationlehre." 1877.
[9] Ibid.
[10] "Comment. in Hipp. de Vict. Acut." iv. p. 120. Lugd. 1543, 12.
[11] Malavicini: "Util. Collect. Med. Phys." Venet, 1682.
[12] "Opera Chirurgica," Uffenbach's "Thes. der Chirurg." Francof, 1610.
[13] "Opera Chirurgica." Francof, 1620.
[14] "De Vocis et Auditus Organo." Ferrara, 1600.
[15] "Sur la bronchotomie, vulgairement dicte laryngotomie, ou perforation de fûte au tuyau du poulmon." Paris, 1620.
[16] "De efficaci Medicina Chirurg. efficacis," pars ii. cap. xl. p. 93.
[17] "Epist. de Laryngotomia." 1646. This memoir is cited by Heister, op. cit.

Scultetus,[1] Verduc,[2] Dionis,[3] and Garengeot,[4] whilst Dekkerus,[5] of Leyden, was the first to recommend a cutting trochar. In the middle of the eighteenth century Dethartig[6] employed the operation of bronchotomy in cases of drowning. An important advance was made in the second half of the eighteenth century, when George Martin[7] introduced the double canula. This valuable suggestion was, however, soon forgotten. The advocacy of tracheotomy by Louis,[8] especially in the case of foreign bodies in the air passages, was most judicious, but many practitioners opposed the operation as very dangerous. The learned Van Swieten,[9] who was amongst the opponents of the operation, nevertheless recognized the value of Martin's inner tube. Soon after, we find the operation mentioned by Le Dran,[10] Platner,[11] and Sharp.[12] The last named surgeon, however, looked upon it as useless and dangerous in inflammation of the air passages, and only advisable in cases where a bronchocele pressed on the windpipe. Bauchot,[13] apparently unacquainted with Dekkerus' instrument, introduced a similar tracheotome, and Heister[14] described the operation accurately, and employed a straight tube and trochar; he gave illustrations both of his own instrument and of that of Dekkerus, and was the first surgeon who used the term "tracheotomy." Richter[15] recommended the operation in the case of large nasal and pharyngeal polypi, in severe inflammation of the tongue, and in cases where the tonsils were greatly swollen. Desault[16] insisted on the value of laryngotomy in cases where foreign bodies were impacted in the larynx, but Home[17] was the first to recommend tracheotomy in croup; he was soon supported by Crawford,[18] Chaussier,[19] Schwilgue,[20] and others. Shortly afterwards Vicq d'Azyr[21] wrote a memoir advocating crico-thyroid laryngotomy, and was strongly seconded by Fourcroy.[22] In the year 1782, John Andrews,[23] a London surgeon, performed tracheotomy successfully. In the year 1825 Bretonneau,[24] who had previously operated with fatal results, opened the windpipe of a child suffering from diphtheria. The case recovered, and in 1833 Trousseau[25] had a similar success. The unbounded enthusiasm of

[1] "Armamentarium Chirurgicum." Amstelodami, 1672, p. 127.
[2] "Opérat. de Chirurg." Paris, 1703, p. 221.
[3] "Opérat. de Chirurg." Paris, 1708, p. 329.
[4] "Opérat. de Chirurg." Paris, 1720, vol. i. p. 491.
[5] "Exercitat. Pract." Lug. d. Bat. 1694, p. 241.
[6] Haller: "Diss. Chirurg," vol. ii. pp. 438-439.
[7] "Philosoph. Trans." vol. vi.
[8] "Mémoire sur la Bronchotomie"—"Mém. de l'Academ. Roy. de Chir." 1760.
[9] "Commentar. in Hermann Boerhavii Aphorism." Aph. 813, &c. 1741-42.
[10] "Opérat. de Chirurg." Paris, 1742, p. 219.
[11] "Institut. Chirurg. Rationalis," Lipsiæ, 1758, p. 327.
[12] "A Treatise of the Operations of Surgery," 4th edit. London, 1761, p. 187.
[13] "Mémoires de l'Acad. de Chir." vol. iv. p. 506.
[14] "A General System of Surgery," part ii. chap. cii. London, 1743.
[15] Max Schüller: "Deutsche Chirurgie," Lief. 37, p. 4.
[16] "Œuvres Chirurg." Paris, 1812, vol. ii. p. 236.
[17] "An Enquiry into the Nature, Causes, and Cure of Croup." Edin. 1765.
[18] "Dissert. de Cynanche Stridula." Edinbourg, 1771.
[19] Nauche: "Pyrétologie de Selle." Paris, 1800.
[20] "Recueil d'Observ. et des Faits relat. au Croup." Paris, 1808.
[21] "Soc. Roy. de Méd." T. i. 1776.
[22] "De Nova Laryngotomiæ Methodo." Th. Paris, 1779.
[23] Borsieri's "Institutes." The information is contained in a letter addressed by Andrews to Borsieri.
[24] "Des Inflam. Spéciales du tissu Muqueux." Paris, 1826.
[25] "Clinique Médicale."

the latter operator, his immense industry and careful attention to details, not only before but during and after the operation, soon established the position of tracheotomy in modern surgery. It was not, however, till twenty-five years later that Roget [1] joined the tube to its shield by means of a collar permitting movement between the two parts. Amongst those who in recent times have sought to modify the instruments, to improve the method of procedure, to determine the relative merits of the various operations on the air passages, or to lay down more clearly the indications for the performance of these operations, may be particularly mentioned Millard,[2] Chassaignac,[3] Malgaigne,[4] Kühn,[5] Thompson,[6] Pitha,[7] Ulrich,[8] Hueter,[9] Bardeleben,[10] Fuller,[11] Marsh,[12] and Planchon.[13] In 1868 Durham [14] introduced the right-angled canula, and since then Llewelyn Thomas,[15] Solis Cohen,[16] Thornton,[17] Baker,[18] Sanné,[19] and Krishaber [20] have contributed their experience. The most complete book, however, which has been published in recent years is that of Dr. Max Schüller,[21] which has just appeared.

[1] "Archives Générales de Méd." 1859.
[2] "Thèse de Paris." Paris, 1858.
[3] "Leçons sur la Trachéotomie." Paris, 1869.
[4] "Médecine Opératoire." Ed. 7me. Paris, 1861, pp. 525, 528.
[5] "Die künstliche Eröffnung der Obersten Luftwege." 1864.
[6] "Lancet." 1853, vol. i. p. 221.
[7] "Beitr. zur Würdigung der Bronchotomie." Prag. Vierteljahreschrift, 1857, Bd. i.
[8] "Compendium der chir Operationslehre." Wien, 1862, p. 652.
[9] "Pitha u. Billroth's Handbuch," vol. iii.
[10] "Lehrb. d. Chirurg." Berlin, 1876, vol. iii. pp. 496, 505.
[11] "Trans. of Med. Chir. Soc." 1857, vol. xl. p. 69, et seq.
[12] "St. Barth. Hosp. Reports." 1867, vol. iii. p. 331.
[13] "Faits Cliniques de Laryngotomie." Paris, 1869.
[14] Holmes' "System of Surgery," vol ii. p. 497, et seq.
[15] "Lancet," Sept. 28th, 1872.
[16] "Croup in its relation to Tracheotomy." Philadelphia, 1874.
[17] "Tracheotomy." London, 1876.
[18] "Lancet," Dec. 2, 1876.
[19] "Traité de la Diphthérie." Paris, 1877.
[20] "Annales des Maladies de l'Oreille," &c. 1876-78.
[21] Billroth und Luecke: "Deutsche Chirurgie"—"Die Tracheotomie, Laryngotomie und Extirpation des Kehlkopfes." Stuttgart, 1880.

In reviewing the history of tracheotomy, the following matters are specially worthy of attention: (1) The idea of opening the trachea in very remote times and its general acceptance in the Renaissance period; (2) the use of a canula—a straight one—by Sanatorius; (3) the addition of wings acting as a shield to prevent the canula dropping down the trachea by Fabricius ab Aquapendente; (4) the introduction of a curved tube instead of a straight one by Casserius; (5) the invention of the double canula by Martin; (6) the articulation of the tube to its shield, permitting of movement between the parts, by Roget; and (7) the use of angular tubes (the angles of which are of course eased off) by Durham.

*Indications for opening the Air-Passages.*—Tracheotomy and its kindred operations may be performed under a

great variety of conditions, but the relief of immediate or prospective dyspnœa is always the direct aim of the operation.[1] As this subject is treated with considerable detail in the various text books of surgery, and is entered into at some length in many articles in this work, it can only be referred to here in a general way

The question which always arises in the mind of the young surgeon is whether the symptoms are sufficiently urgent to render the operation necessary. On this point I think it desirable to remark that the indication for the operation is to be looked for in the condition of the thorax. It is the recession of the lower part of the sternum and contiguous ribs, and the retraction of the intercostal spaces and clavicular fossæ at each act of inspiration which call for tracheotomy, and the operator must not wait until lividity of the lips and blueness of the finger nails prove that the blood is being imperfectly oxygenated. It is, of course, especially in acute diseases of the larynx that tracheotomy yields the most satisfactory results, but in tracheal affections the operation often assists in bringing about a cure. When the disease of the trachea, however, is low down, as in some cases of tracheal stricture and tracheal compression, the operation is useless. It is true that great skill is required in detecting the exact site of these affections (see page 534), but it is better in a doubtful case to operate than to let the patient die without making any effort to relieve him. In cases of aneurism of the aorta, the operation must, as a rule, be avoided, but where that disease is associated with spasm of the glottis, or with complete paralysis of one of the abductors, tracheotomy may be required (see Case 2, page 443). It would seem scarcely necessary to call the attention of even the most inexperienced to the subject of asthma, but in two cases I have been requested by practitioners to perform tracheotomy in that complaint, bronchial asthma having been mistaken for spasm of the glottis. In reality, however, the diagnosis of asthma from laryngeal and tracheal obstruction is very simple. In the latter affections the dyspnœa is always inspiratory, whilst in asthma it is mainly expiratory, and is never accompanied with that retraction of the chest walls, which is noticed when the upper air-passages are affected.

[1] In the case of the extraction of a foreign body, its removal is no doubt the immediate object of the operation, but still it falls within the category described in the text. The proper method of procedure in these cases will be described in the article devoted to the subject.

Further, in bronchial asthma the characteristic sounds are moist sibilant râles, heard most distinctly in expiration. It is sometimes difficult to distinguish laryngeal dyspnœa from the dyspnœa of tracheal obstruction. The diagnostic criteria of the former are an up-and-down movement of the part of the larynx, considerable stridor, and generally an alteration in the voice; whilst tracheal obstruction is characterized by a peculiar hissing noise (see "Tracheal Stricture"), caused by the air passing through the narrowed canal, and an absence of movement on the part of the larynx.

*The Use of Anæsthetics.*—Notwithstanding the conclusion arrived at by the Committee of the Medico-Chirurgical Society,[1] I consider that the administration of chloroform increases the risk of the operation, for if any blood passes down the trachea, the chance of suffocation is much greater when the patient is unconscious. I have myself seen two cases in which this accident occurred under chloroform with a fatal result, whilst, on the other hand, I have several times seen life saved by the active efforts of the patient in expectorating blood. General anæsthesia should therefore, if possible, be avoided, and indeed in adults it is very seldom required. It may, however, be necessary to induce it in the case of children, in order to prevent their violent struggles, when the operator is alone or has an insufficient number of assistants. Owing to the irritating effect of æther on the laryngeal mucous membrane, chloroform should be employed if it is necessary to administer a general anæsthetic; local anæsthesia, *i.e.*, freezing effected with the æther spray, is, however, as a rule, all that is really requisite.

*Accessory Appliances.*—The following accessories should be at hand, viz., a freezing apparatus for the application of the æther spray; small sponges for absorbing the blood; tapes for tying in the canula; a bolster about the size of a rolling pin tighly packed with bran for placing under the patient's neck, a faradic battery for stimulating the respiratory muscles in case the respiration should become feeble after the trachea has been opened, and bellows for effecting artificial respiration. The best instrument of the kind is that of Dr. Richardson.[2]

*Duties of Assistants.*—It is sometimes necessary to perform the operation very suddenly, and the practitioner may even

[1] "Trans. Med.-Chir. Soc." 1864, vol. xlvii. p. 323, et seq.
[2] "Med. Times and Gaz." December 4, 1869.

find himself compelled to open the windpipe when he is quite alone with the patient; but if it is possible to arrange for the operation beforehand it is desirable to have three assistants, viz., one to freeze the neck in the first instance, and afterwards to sponge the wound; another to maintain the head perfectly steady and the axis of the neck straight—a condition which he can best secure by standing behind the patient and placing his hands on either side of the head, with the fingers below the jaw; and a third assistant may be required to secure the arms and legs of the patient, especially in the case of children.

*Position of the Patient and the Operator.*—If it be a bright day, the patient should be placed opposite the window in the recumbent position, and on a dark day, or at night, the strongest available means of illumination should be employed; in the later stages of the operation the frontal reflector of a laryngoscope is often of great service in throwing the light into the wound. The patient's shoulders should be raised and the neck slightly thrown back over the bolster already described. In some instances, when the recumbent position produces dyspnœa, the operation must be performed with the patient sitting upright. The most convenient position for the operator is on the right side of the patient.[1]

*Selection of a suitable Canula.*—The advantages of a right-angled tube have already been pointed out (page 510), and it now only remains to make a few remarks on the *size* of the tube to be selected. For adult men a No. 1 tube should be chosen; for adult women No. 2; for boys and girls from ten to fifteen years of age No. 3 generally suffices, though occasionally No. 2 can be used; under ten No. 4 can generally be employed, though under one year a smaller tube may be required.

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### Tracheotomy.

As already explained (page 500) there are two situations in which the trachea may be opened, viz., above and below the

[1] When tracheotomy is performed for the purpose of plugging the trachea (as in the case of serious operations on the tongue or jaws), the patient's head, supported by an assistant, may be allowed to hang over the end of the operating table. His mouth must be held open and his tongue kept well out with blunt forceps. The operator, sitting opposite the head of the patient, makes the usual incision but in reverse (Rose: "Archiv Klin. Chir." Bd. 17, 1874). It need scarcely be remarked that this method is not suited for cases in which the operation is performed to relieve dyspnœa.

isthmus of the thyroid gland; the former is called "superior tracheotomy," the latter "inferior tracheotomy," and as the lower operation is most frequently practised in this country, it will be first described.

INFERIOR TRACHEOTOMY.—There are three stages in tracheotomy: First, to lay bare the trachea; secondly, to divide it; and, thirdly, to insert the canula.

*First Stage of Operation.*—Before making the first incision, the operator should inspect the neck, and notice its salient points. The prominent thyroid cartilage can generally be seen and always felt. The cricoid cartilage is also, as a rule, easily perceived with the fingers, and except in the case of very fat infants the rings of the trachea can usually be made out. In performing the operation two cardinal rules should always be borne in mind, viz., first, to operate slowly, and, secondly, to use the knife as little as possible, except for the first incision through the skin, and for the final division of the rings of the trachea. These rules, however, must of course be ignored when the dyspnœa is urgent. Under these circumstances it may be necessary to plunge the knife into the trachea without any preparatory dissection. The integument in the laryngo-tracheal region having been frozen, an incision should be made through the skin exactly in the middle line commencing opposite the second ring of the trachea and extending downwards towards the sternum. A free external incision cannot be too strongly insisted on, not only because it facilitates the subsequent stages, but also on account of its diminishing the risk of subcutaneous emphysema. The knife always penetrates through the outer layer of superficial cervical fascia, and the deep layer comes into view. On carefully dividing this layer, a loose areolar tissue, containing more or less fat and generally some engorged veins, is met with. At this stage the isthmus of the thyroid gland generally comes into view at the upper part of the wound, and in young children the thymus gland is sometimes seen below. In proceeding with the operation, the point of the knife should, as much as possible, give way to the handle; if it be found impossible to avoid a vein it should be divided between a double ligature. It is at this period of the operation that arterial hæmorrhage is apt to occur, though a small vessel may be accidentally opened at an earlier stage. The bleeding can generally be readily stopped at once by pressure, or by the application of a small lump of ice, but if these measures do not succeed the vessel must be tied or twisted.

If a ligature is applied both its ends should be cut short, for if one end is left it is likely to be torn away when the canula is subsequently introduced. The deep layer of the deep cervical fascia may require the point of the knife, but it can as often be cleared away with the handle.

*Second Stage.*—When the tracheal rings have been well exposed, the operator should open the trachea by inserting a sharp scalpel exactly in the middle line, with its edge directed upwards, whilst he steadies the tube by pressing on it gently but firmly with the forefinger of his left hand. The incision should be made through two or three rings, and whilst sufficient force must be used to penetrate the tough mucous membrane, the knife must not be plunged in too deeply, for fear of wounding the posterior wall of the trachea. If the trachea is strongly ossified and the knife will not divide the cartilages, the tracheal bone forceps should be introduced through the small opening which has been made between the rings, and then carried upwards. If the trachea is undergoing rapid up-and-down movements it is a good plan to insert a tenaculum into its upper part, just below the cricoid cartilage, and to draw it well forward before the incision is made. This procedure is often desirable in the case of children, owing to the small size of the trachea. Directly the trachea is divided a hissing noise (caused by the rapid passage of air through the narrow opening) is perceived. At the same there is frequently spasmodic irritation of the larynx and violent coughing.

*Third Stage.*—Immediately after dividing the trachea the operator should introduce his left forefinger into the tracheal wound, and not remove it until he has inserted the canula.[1] At this critical moment I have often seen young surgeons fail. Sometimes the difficulty arises from the tracheal rings not having been sufficiently divided, sometimes it is caused by the canula being pushed into the tissues of the neck in front of the trachea, instead of into the trachea itself. If the opening in the trachea is too small it should be slightly enlarged with the guarded bistoury, and a second attempt made to insert the canula. In order to facilitate the intro-

[1] If the operation has been performed for the removal of a foreign body, of course no canula is introduced, but the sides of the trachea are held open by retractors, when on coughing the patient often expels the foreign body. If this does not occur, the offending substance has to be searched for and if possible extracted (see "Foreign Bodies in the Trachea").

duction of the canula some surgeons use Trousseau's dilator, an instrument somewhat resembling curved forceps, terminating in thickened bulb-like points. The dilator is inserted closed into the wound, and is then opened, when a space is left between the blades through which the canula can be introduced. If, however, the ordinary canula is provided with a proper pilot, the dilator is totally unnecessary.* After the canula has been inserted, the operator should hold it in position until it is firmly secured with tapes. An inner tube should then be introduced into the canula, and the edges of the wound above and below the tracheal shield brought together, either by strips of plaster or stitches.

*Dangers during the Operation.*—The great danger during the operation is hæmorrhage after the trachea has been opened, but before the canula has been inserted. This risk is best avoided by not opening the trachea until all bleeding has been arrested, and particularly by taking care (by previous thorough exposure of the trachea) that no vessel is wounded in the final incision which lays open the windpipe. The accident not unfrequently occurs in the following manner:—The windpipe having been opened, the young surgeon has perhaps some difficulty in inserting the canula; he is accordingly obliged to enlarge the first opening, and in doing so wounds a vessel. By the inspiratory efforts of the patient blood is then quickly drawn into the trachea and bronchi, and in a few seconds the patient may be on the verge of suffocation. The canula must be introduced as quickly as possible, and if the blood is not quickly coughed up the surgeon must apply his mouth to the orifice of the tracheal tube and suck out the blood, unless he should be so fortunate as to have at hand an apparatus which can effect a similar result (page 547); if, however, the surgeon has been unable to introduce the canula and the patient is in danger of being suffocated by blood pouring down the trachea, Hueter's suggestion, that a flexible catheter should be passed into the windpipe and the blood sucked up through it may be carried out. Indeed, even if the canula has been introduced, it is sometimes more convenient to draw the blood out by a catheter passed through the canula than by applying the mouth direct to the latter. It is when blood passes into the windpipe that artificial respiration, promptly, steadily, and perseveringly carried out, is of such great value, often rescuing the patient from apparent death. But, if respiration be not quickly re-established his

energy must be stimulated to the utmost by faradism. A strong current should be used, the positive electrode being placed over one of the pneumogastric nerves in the neck, and the negative electrode over the thoracic insertions of the diaphragm; whilst the intercostal muscles should be directly stimulated. As a possible danger, the entrance of air into a vein must be mentioned, but it is so rare an accident that even those who have had the largest experience in tracheotomy have never met with it. The only treatment of any avail consists in immediately compressing the vein with the finger and thus preventing the further entrance of air; stimulants should at the same time be freely administered, and the action of the heart promoted by a strong faradic current.

*After-treatment.*—As soon as the tracheal canula is safely secured in the windpipe, the after-treatment must be considered. Immediately after the operation the patient should be propped up in bed or supported by a bed-rest, and if there is no tendency to hæmorrhage, he should be allowed to go to sleep. Previous to the operation there has frequently been sleeplessness for several days and nights, and, as soon as it is over, the exhausted patient often falls into a long and refreshing sleep. Either before going to sleep, or as soon as he wakes, the patient should be given some beef-tea or milk, and if there is much depression a stimulant may be added; and as liquids have a tendency to pass into the windpipe he should be directed to swallow very carefully. It is a common practice to surround the patient with a warm moist atmosphere, by means of a steam kettle or other apparatus, but, except in the case of diphtheria, I do not recommend this measure. For the first three or four days after the operation the patient should be carefully watched by a competent nurse, who ought to know how to remove and replace the inner tube. If inspissated mucus collects in the canula it should be removed with a feather during the first few hours after the operation, as the changing the inner tube at this early stage is apt to disturb and pain the patient. It is better not to remove the outer tube until the third or fourth day, unless it causes great inconvenience. At this period also sutures may be removed.

*Dangers following the Operation.*—The most important dangers following tracheotomy are: Syncope, broncho-pneumonia, secondary hæmorrhage, general emphysema, cervical cellulitis, blocking of the canula, displacement of the canula,

and ulceration of the trachea. These dangers will now be briefly passed in review. Syncope is most to be feared in the case of old people and in those cases in which the operation has been too long postponed. It is often associated with carbonic acid poisoning. Broncho-pneumonia must be especially feared when the operation is performed on account of diphtheritic inflammation of the throat or air passages. If it does not occur in the first three or four days it need not be apprehended. Secondary hæmorrhage is comparatively rare, but an example has been reported by Böckel,[1] and I have myself met with two cases. In one of these the patient was operated on by Mr. Francis Mason some years ago, on account of acute laryngitis; no blood was lost during the operation, but the patient succumbed a few days afterwards from secondary hæmorrhage. In the other case the patient was a man sent to me by Dr. Mills, of Ipswich, in August, 1879, on whom I performed superior tracheotomy. In this case, although the hæmorrhage was very severe on two occasions a week after the operation, the bleeding was ultimately arrested by the internal administration of ergot of rye. It is exceedingly difficult to deal with these cases of secondary hæmorrhage. Of course if the blood is pouring forth when the surgeon arrives, he must endeavour to find the bleeding vessel, if necessary, enlarging the wound for that purpose; but it often happens that though the hæmorrhage may have been profuse, it has ceased before the practitioner can attend. Under these circumstances the wound should not be disturbed, but the nurse should be provided with a styptic solution and taught how to apply pressure at the bleeding point, in the event of a recurrence of the hæmorrhage. At the same time, ergot of rye should be either administered internally or injected subcutaneously. Subcutaneous emphysema may either take place during the operation from making too small an opening in the windpipe, or may gradually come a few hours after, owing to the tracheal wound not corresponding to that in the integument, but being made on one side of the windpipe. As a rule it soon subsides spontaneously, and it is rarely necessary either to rectify the tracheal wound or to scarify the skin. Cervical cellulitis is a more dangerous but a much rarer accident. It occasionally results from using too great violence with the handle of the knife (which the surgeon very properly employs to a considerable

[1] "De la Trachéotomie dans le Croup." Thèse de Strasbourg, 1867.

extent, in order to avoid causing hæmorrhage with the blade); and it is also not unfrequently the result of clumsiness in originally inserting the canula, the young surgeon sometimes greatly irritating the tissues whilst trying to introduce the tube. Should this complication arise, it must be treated on ordinary surgical principles, great pains being taken to prevent the burrowing of pus into the anterior mediastinum. In conclusion, attention must be called to the fact that the tube may get blocked up by inspissated mucus or false membrane, or, becoming displaced, it may be forced out of the trachea, and lie in front of it in the tissues of the neck. These complications are the result of carelessness, and ought never to occur. Ulceration of the trachea may sometimes take place as

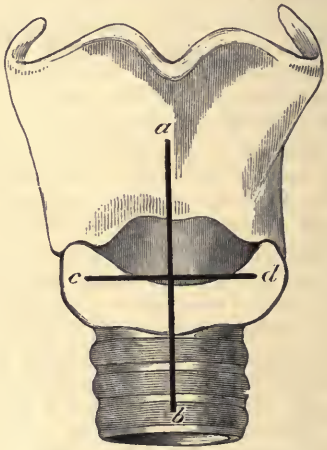


FIG. 112.—DIAGRAM SHOWING THE POSITION OF THE WOUNDS IN BOSE'S OPERATION.

the result of the tube not fitting, but this is an accident which I have never known to happen when a right-angled tube has been used. Fracture of the canula, and its passage into the trachea, is a remote contingency which cannot be regarded as one of the legitimate dangers of tracheotomy. The subject has been briefly referred to under "Foreign Bodies in the Trachea" (page 563).

SUPERIOR TRACHEOTOMY.—From a very early period some surgeons have recommended that the trachea should be opened above the isthmus, but it has generally been considered, in

the case of children at least, that there was not sufficient room in this situation. Latterly, however, the operation has been revived with some modification by Professor Bose,[1] and it is now commonly performed in Germany. The following is the mode of procedure:—A longitudinal incision is made (Fig. 112, *a b*), beginning over the middle of the thyroid cartilage and carried downwards to the lower border of the proposed tracheal opening. This incision is to be carried through the skin and the subcutaneous tissue till the superior layer of the deep cervical fascia is reached. The expansion of this incision is then effected by means of a spring dilator inserted in the middle of the wound, and a horizontal incision (*c d*), about half an inch in length, corresponding to the lower border of the crico-thyroid membrane, is made through the superficial layer of the deep cervical fascia. A director is then inserted from above between the deep layer of the deep cervical fascia and the cricoid cartilage, and both layers of fascia and everything which is between them (venous plexus, isthmus of the thyroid gland) is carried down by simply raising the director. The whole field of operation being now free, the opening of the trachea is made in the usual way. It is highly probable that on account of its much greater safety this operation will entirely supersede the old operation.

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### Laryngotomy (Crico-thyroid).

This operation was originally suggested by Vicq d' Azyr,[2] was subsequently recommended by Fourcroy,[3] Benjamin Bell,[4] Desault,[5] Roux,[6] and Malgaigne,[7] and has recently been advocated by Timothy Holmes,[8] Roser,[9] Krishaber,[10] and Choukry.[11]

[1] "Tracheotomia Sup."—"Archiv für Klin. Chirurgie." Bd. xiv. pp. 137, 147

[2] Op. cit.

[3] "De Novâ Laryngotomiæ Methodo." Paris, 1779.

[4] "System of Surgery." 1783.

[5] "Œuvres Chirurgical." 1813, t. ii. p. 276.

[6] "Archiv. Méd." 1831, 1re s. t. xxvii. p. 545.

[7] "Méd. Opér." l ii. p. 291.

[8] "Diseases of Infancy and Childhood." Lond. 1869, p. 315.

[9] "Path. Chir." 1870, p. 291.

[10] "Annales des Maladies de l'Oreille," &c. December, 1878.

[11] "De la Trachéotomie et de la Laryngotomie Intercrico-thyroïdienne," &c. Th. Paris, 1878. An excellent historical sketch of the operation has been recently published by Dr. Nicaise ("Annales des Maladies de l'Oreille," &c. December, 1878), to which I am indebted for many of the above references.

The arguments against laryngotomy especially brought forward with much ability by Mr. Marsh[1] are—(1) That the crico-thyroid space does not admit a sufficiently large tube; (2) that the insertion of a canula through the crico-thyroid membrane interferes with the integrity of the larynx, and prevents the proper tension of the vocal cords; (3) that the tube in this situation gives rise to more irritation; and (4) that the retention of a tube in the crico-thyroid space is apt to produce serious inflammation, and even necrosis of the cartilages. Most of these dangers are of an entirely chimerical kind, and the measurements of Mr. Timothy Holmes show that the lumen of the cricoid cartilage is so much greater than that of the glottis, that ample breathing room can be obtained by an opening through the crico-thyroid membrane. After perusing the details of the operation set forth in the next paragraph, it will be seen that laryngotomy is a very easy operation as compared with tracheotomy, and that the fear of hæmorrhage may be almost ignored. Hence, in a sudden emergency where suffocation threatens, this operation should be performed, especially if the practitioner is alone with the patient.

In performing the operation a vertical incision should be made in the median line through the integument commencing over the centre of the thyroid cartilage, and extending downwards for an inch to an inch and a half. The crico-thyroid membrane should then be opened by a transverse incision, the crico-thyroid artery being pushed on one side by the forefinger of the left hand. On dividing the superficial layer of the deep cervical fascia a plexus, formed by the crico-thyroid veins, comes into view, which should be pushed on one side; more rarely an extension of the thyroid gland is seen projecting from the isthmus up to the crico-thyroid space. If present this structure must be treated in the same way as the veins. In some cases, in order to obtain sufficient space, it is necessary to make a crucial incision, or even to separate the membrane from the thyroid and cricoid cartilages at every point of connection. The canula is then inserted in the manner already described in speaking of tracheotomy. As Vicq d' Azyr and Fourcroy first pointed out, it is better to use a flattened tube, that is to say, a tube with an oval instead of a circular lumen, the longer diameter of the tube corresponding to the transverse diameter of the crico-thyroid space.

[1] "St. Bart. Hosp. Reports." 1867, vol. iii. p. 331.

### Laryngo-tracheotomy.

This operation consists in carrying the incision through the crico-thyroid membrane, the cricoid cartilage, and the first one or two rings of the trachea. It is an operation which is very seldom performed except for the removal of a large growth or foreign body from the larynx.

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### On Thermo-Cautery in Laryngo-Tracheal Operations.

The danger of hæmorrhage in opening the trachea has always been a very serious feature in the operation, and various expedients [1] have been adopted with a view of preventing it. In 1870 Amussat [2] first made use of galvanic cautery in performing tracheotomy, but he did not publish the result till 1872, when Verneuil [3] reported the result of a similar operation; in 1874 Krishaber [4] published two cases in which he had adopted the same method for opening the trachea, and he has since reported three additional cases,[5] whilst Tilleau,[6] Voltolini,[7] v. Bruns,[8] and Böckel [9] have also recorded similar examples. Recently Paquelin's thermo-caustic knife has been used by Dr. Poinsot,[10] of Bordeaux. It appears to me that the use of thermo-cautery for opening the air-passages merely introduces an unnecessary complication into the operation. Although it reduces the chance of serious hæmorrhage it does not absolutely prevent it. According to some experiments made by M. Nicaise [11] hæmorrhage does not occur when arteries having a diameter of half a millimetre to one millimetre are divided by a platinum knife heated to a dull red colour, nor when veins of a somewhat larger diameter

1 The suggestion of M. Guérin that tracheotomy should be performed subcutaneously, and that of M. Chassaignac that the operation should be carried out with the *écraseur*, must be looked upon as ingenious curiosities of surgery. It has even been recommended by Dufardin (Kühn, loc. cit.) to open the trachea by means of a caustic paste.

2 "Bull. de Thérapeutique." 1872, p. 472.

3 "Bull. de l'Acad. Méd." 1872, p. 299.

4 "Memoirs de la Société de Chirurgie." 1874.

5 "Annales des Maladies," &c. tome ii. p. 67.

6 "Gaz. des Hôp." 1874, p. 281.

7 "Berl. Klin. Woch." 1872, Nro. 41.

8 "Galvano-Chirurgie." 1870, p. 54; and Paul Bruns, "Berl. Klin. Woch." 1872, Nro. 53.

9 Ibid. December 31, 1878.

10 "Lancet," February 16, 1878.

11 "Annales des Maladies," &c. December 31, 1878.

are opened, but if vessels of greater size are cut into, blood flows. It may be added that erysipelatous inflammation sometimes attacks the wound as the result of the burn. Should thermo-cautery be employed it is better to limit its use to the soft tissues, and when the trachea is reached, to open it with a scalpel. As Krishaber has pointed out, the thermo-caustic knife should not be pressed heavily against the skin, but a succession of light touches should be made.

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### Withdrawal of the Canula.

When tracheotomy is performed on account of acute disease, it is extremely important, especially in the case of children, to dispense with the canula as soon as the laryngeal obstruction has passed away; for if the canula is retained too long it is sometimes difficult, if not impossible, to do without it. This difficulty may arise from several causes: thus, on closing the tracheal wound, the passage of air through the larynx may give rise to spasm of the glottis, or the abductors of the vocal cords may have become paralysed, or the laryngeal and sub-laryngeal canal may have become blocked up by granulations or cicatricial contraction, or possibly the trachea may be thrown into a state of spasm, or its walls may collapse. In two cases which have come under my own notice spasm of the glottis appeared to be the essential cause of the difficulty; both the patients were young children, and in both, immediately before removing the canula, its shining surface could be easily seen with the laryngoscope through the glottis, showing that there was no paralysis of the abductors of the vocal cords. I do not, however, feel absolutely certain as to the diagnosis of these cases, and think it possible that the dyspnœa which arose when the canula was removed may have been due to partial collapse, or even to spasm of the tracheal walls above the canula. One of these patients ultimately died, but no post-mortem was permitted; the other case passed out of my hands, and I do not know what was the subsequent result. Paralysis of the laryngeal muscles (abductors) was first stated by Trousseau[1] to be a cause of difficulty in withdrawing the tracheal canula. That this condition sometimes actually arises after tracheotomy has been proved laryngoscopically by Gerhardt,[2] but I believe that it is exceedingly rare, and that most of the cases in which it has been

[1] See page 450. [2] Ibid.

supposed to exist, have, on the other hand, been of a spasmodic character. There is quite an extensive bibliography[1] as to the occurrence of granulations after tracheotomy in the supra-tracheal region, whilst contraction of the laryngo-tracheal canal, and the union of its opposite walls, are by no means uncommon in tertiary syphilis of this region. The spasmodic and paralytic affections can be best treated by plugging the tube for increasing periods of time and administering nervine remedies suitable in the opposite conditions. Granulations can be easily got rid of by passing gutta percha or laminaria bougies.[2] Cicatricial contractions can sometimes be overcome to some extent by assiduous dilatation, but they generally relapse as soon as the treatment is discontinued.

## TRACHEOCELE.

*Latin Eq.*—Tumor aerius asperæ arteriæ.
*French Eq.*—Trachéocèle.
*German Eq.*—Tracheocele.
*Italian Eq.*—Tracheocele.

DEFINITION.—*An air-containing tumour situated on the front of the neck, sometimes unilateral, sometimes bilateral, communicating with the interior of the trachea by a small opening.*

*Etiology.*—This affection is very rare, but cases have been described by Ammon,[3] Behr,[4] Rokitansky,[5] Lizé,[6] Gayet,[7] Leriche,[8] Förster,[9] Guyon,[10] Devalz,[11] Faucon,[12] Fischer,[13] and Eldridge[14] of Yokohama. The last named physician, in

[1] Max Schüller: Op. cit. p. 19.
[2] Thomas Smith: Loc. cit. p. 230.
[3] "Die angeborenen chi. Krankheiten," &c. Berlin, 1842, p. 54. Ammon remarks: "There is only a single instance of congenital tracheocele on record—a case very imperfectly described by Von Gohl, in which the affection was complicated with bronchocele.
[4] "Wochenschr. f. d. ges. Heilkunde." Berlin, 1836,-361, 368.
[5] "Oest. Jahrbücher," 16 Bd.
[6] "Bull. Soc. Chir. de Paris." 1861, p. 529, et seq.
[7] "Compte Rendu de la Soc. des Sciences Méd. de Lyons." 1865-6, t. 5.
[8] Ibid, 1868.
[9] "Patholog. Anat." vol. ii. p. 310.
[10] "Gazette Heb." June 24, 1873.
[11] "Gazette des Hôp." Nov. 8, 1873.
[12] "Archives Méd. Belges." Jan. 1874.
[13] Pitha and Billroth's "Handbuch," Bd. 3.
[14] "American Journ. of Med. Sci." July, 1879.

addition to publishing a case occurring in his own practice, has collected nearly all the recorded examples of the disease, and has written a very excellent article on the subject. The origin of the disease is extremely obscure, and it is quite possible that it may proceed from various causes. There can be no doubt that in rare cases it is due to imperfect evolution, either from defective closure of one of the bronchial clefts, or merely from feeble development of one of the intercartilaginous spaces of the trachea. In two cases[1] the disease existed from birth, and in one of these two, viz., that of v. Gohl, it was associated with an irregular development of the thyroid gland. More often the affection appears to be the result of some accidental straining. In one case[2] it appeared to originate during the act of vomiting; in another[3] it was first perceived during an attack of bronchitis attended with violent cough. It is more frequently met with in men than in women.

*Symptoms.*—When present, tracheocele can scarcely fail to be recognized. During ordinary respiration there may be only a slight fulness in front of the neck; but on forced expiration, with the mouth and nose closed, a tense tumour becomes apparent. This tumour occupies a position corresponding to a great extent to that of the thyroid gland; sometimes it is median, sometimes on one side, whilst occasionally it is bilateral, and consists, in fact, of two tumours. In one instance the neck measured 40·5 centimetres in ordinary respiration, whilst in forced expiration, with nose and mouth closed, its circumference was 49 centimetres.[4] By pressure externally whilst the patient stops breathing or inspires, the tumour can sometimes be effaced or prevented from forming, but as the communication with the trachea is sometimes at the back of that tube, it cannot always be commanded. Sometimes[5] on deep inspiration the tumour seems to disappear altogether, but as a rule the existence of the sac under the skin can be perceived with the finger even when it is not distended. A distinct impulse is conveyed to the sac when the patient coughs. In Dr. Eldridge's case, on making a fine

[1] The affection was observed by Faucon in one of his cases, in a child a year and a half old, but it had existed from birth; the other case is that of v. Gohl.

[2] One of Faucon's cases: Loc cit.

[3] Devalz: Loc cit.

[4] Eldridge: Loc. cit.

[5] Gayet: Loc. cit.

opening with the needle into the sac, a stream of air, forcible enough to extinguish a lighted match, was emitted. In one of Faucon's cases, the tumour was tympanitic on percussion, but in most cases there has been an absence of resonance. Dyspnœa is sometimes experienced, though this is quite the exception. When present it is probably an accidental complication of a reflex character, but it may possibly be due to the compression which the distended tracheocele exerts on the windpipe when it is itself pressed on by the sterno-mastoid muscle. Phonation is, as a rule, generally merely weak, but in the case reported by Devalz, the patient's voice underwent a peculiar modification, "each syllable being accompanied with a soft murmur, which prolonged the true laryngeal sound, and surrounded it with a kind of sonorous shadow;" the sound "*ouvouvou*" (pronounced as in French), according to Devalz, gives a very good idea of this whispering noise.

*Pathology.*—The outer covering of the tumour varies as regards composition and thickness according as it remains under the muscles, or becomes subcutaneous. The lining wall generally resembles mucous membrane, and the sac usually contains some mucus or muco-purulent secretion.

*Diagnosis.*—The varying size of the tumour, its increase on forced but obstructed expiration, and the impulse conveyed to the hand when placed upon it, leave no doubt as to its nature. In all the cases recorded, there is only one in which the diagnosis was not at once arrived at, and it probably came under the notice of a practitioner who had never heard of such a condition.

*Prognosis.*—Tracheocele does not, as a rule, appear to be attended with much danger. Where it originates in a congenital deficiency, cure is improbable; but when it has arisen from a violent exertion, it is likely either to be cured or to disappear spontaneously.

*Treatment.*—As a rule, some mechanical appliance for preventing the distension and progressive development of the tumour is all that is required. In one instance, however, the sac was extirpated under the impression that the tumour (which had previously been opened by another surgeon with an escharotic) was a suppurating cervical gland.[1] The ultimate result of this case is not stated, but the dictum of Gayet, that "surgical interference would be worse than the disease," probably deserves general acceptance.

[1] Fischer: Op. cit.

## FOREIGN BODIES IN THE TRACHEA.[1]

*Latin Eq.*—Corpora adventitia in tracheâ.
*French Eq.*—Corps étrangers dans la trachée.
*German Eq.*—Fremde Körper in der Trachea.
*Italian Eq.*—Corpi straniere nella trachea.

DEFINITION.—*Foreign substances lodged in the trachea, most commonly gaining access to that canal from the mouth (after having passed through the pharynx and larynx), but occasionally passing up from the stomach, and more rarely still entering from the neck.*

*History.*—Isolated cases of foreign bodies in the air passages have been recorded from a very early date, but the subject was not treated in a manner at all commensurate with its importance until the year 1759, when Louis[2] discussed it incidentally in a paper on bronchotomy. In 1796 Sabatier[3] devoted a short article to the same subject, and Porter[4] of Dublin, in the year 1837, treated it with considerable detail; while Albers,[5] in 1846, collected a large number of remarkable illustrative cases. The subject, however, was first dealt with in a really exhaustive manner in the year 1854, when the treatise of Professor Gross,[6] of Philadelphia, appeared. This invaluable essay gives full reports of 200 cases, and is so complete that it is doubtful whether it will ever be improved upon; indeed, the excellent articles of Bourdillat[7] and Kühn,[8] subsequently published, the former based on 300 and the latter on 374 cases, only confirm the conclusions previously arrived at by Gross.

*Etiology.*—The foreign bodies found in the trachea generally gain access to it through the larynx, and are usually small; or, if of any size, have a more or less rounded contour, large or irregularly shaped bodies being more likely to become impacted in the larynx. The circumstances under which foreign bodies penetrate into the trachea from above are naturally the same as those under which they gain access

[1] Though in the "nomenclature" and "definition" the presence of foreign bodies is limited to the trachea, it will be found convenient in this article to briefly follow such substances in their peregrinations down the bronchi and into the lungs.

[2] "Mém. sur Bronchotomie"—"Mém. de l'Académ. Roy." &c. Paris, 1760.

[3] "De la Médecine Opératoire," &c. Paris, 1796, tome ii.

[4] "Surgical Pathology of the Larynx and Trachea." Lond. 1837, 2nd ed.

[5] "Atlas der Path. Anat. und Erläuterung dazu." 1846.

[6] "Foreign Bodies in the Air-Passages." Philadelphia, 1854.

[7] "Gazette de Paris," Nos. 7, 9, 10, 13, and 15, 1868.

[8] Günthers: "Lehre v. den blut. Operat." V. Abtheil.

to the larynx as already described (page 411). Thus children are very liable to the accident when they fall asleep with their little playthings in their mouths, and the same is true of persons of all ages who are in the habit of talking, and especially of laughing, during meals. In the latter case the accident is especially likely to happen in taking soup which contains portions of solid meat, vegetables,[1] or foreign bodies which have been carelessly admitted. Sometimes the foreign substances found in the trachea are such as have passed up from the stomach in vomiting, undigested food being generally the peccant matter under such circumstances.[2] This is particularly apt to occur during the vomiting of intoxication. Dr. Smyly[3] has recorded a case of fatal suffocation, in which threadworms found their way into the larynx and trachea.[4] Sharp foreign bodies, such as pins, needles, or the bones of fish or other animals may gradually eat their way from the œsophagus into the trachea, or may be forced into it by violence in attempts to extract them.[5] Sometimes a foreign body reaches the windpipe through the defective construction of an instrument or the carelessness of a patient. Thus in one case[6] the blades of some tube-forceps broke off and fell down the trachea whilst the surgeon was endeavouring to remove a laryngeal growth; and the records of cases[7] are only too numerous in which the same thing has happened to a portion of a tracheal canula, the instrument either having been defectively made or having been allowed to get into an insecure state through want of attention on the part of the patient.

[1] Heister ("System of Surgery," 1743, part ii. sect. 3) quaintly describes how, by means of tracheotomy, he "happily extracted a PIECE of a boiled MUSHROOM which slipped into the TRACHEA of a jocose MAN at Helmstadt with DANGER of SUFFOCATION by LAUGHING while he was eating BROTH in which MUSHROOMS were boiled."

[2] Parrot: "Union Médicale," 1868.

[3] "Dublin Journ. Med. Sci." May, 1866. This article also contains references to two or three other similar cases.

[4] "Lancet," 1839 to 1840, p. 803.

[5] Gross: Op. cit. p. 52.

[6] Reported by Voltolini: "Monatsschrift für Ohrenheilkunde," No. 12, 1879.

[7] In order to find examples of this accident, it is only necessary to look through the indexes of any of the weekly medical journals during the last ten years. Dr. Solis Cohen ("Diseases of the Throat," 2nd edition, p. 663) has collected a large number of illustrative cases.

Lastly, the bronchial[1] or cervical[2] glands, when diseased, occasionally free themselves from their normal surroundings, and work their way into the trachea through an aperture in its wall previously caused by the prolonged pressure of the morbid structure. Cases have also been reported by Fabricius Heldamus,[3] Tulpius,[4] and others in which some of the materials used for dressing deep wounds of the chest have worked their way up into the trachea, and been finally expelled by coughing. A well-known case by which De la Martinière has immortalized himself is worthy of a brief record, if only for the sake of impressing on young surgeons the advantage of the closest habits of observation :—

De la Martinière[5] was called one day by a brother practitioner to a little boy who had been suddenly seized with pain in the throat and shortness of breath whilst amusing himself by cracking a whip. On arriving, he discovered on the skin in front of the upper part of the trachea a minute red spot about the size of a flea-bite, on pressing which a hard swelling, feeling something like a lentil, was perceived at a considerable depth beneath the integument. He cut down upon it, and discovered a brass pin, more than one inch in length, transfixing the trachea and penetrating its posterior wall. This was extracted with tweezers. It was subsequently discovered that the boy had fastened the pin to the end of the lash, in cracking which the pin had flown off and penetrated his neck. The wound healed in a few days.

*Symptoms.*—The symptoms vary greatly according to the size and shape and nature of the foreign body and the exact situation in which it is lodged. If the substance be comparatively large, or if a quantity of fluid enter the air passages, the patient may be suddenly suffocated, and fall down dead;[6] and even if it be not quite large enough to cause instant death, it may still give rise to fatal apnœa in the course of a few minutes. Under the latter circumstances the patient is seen to be suffering from a painful attack of suffocation, which he probably tries to relieve by putting his finger down his throat, and making immense inspiratory efforts. The face soon becomes cyanotic, cold

[1] Edwards: "Med.-Chir. Trans." vol. xxxvi.; Dr. Henry Thompson: "Med. Times and Gaz." Jan. 24, 1874; and Dr. George Johnson: "Brit. Med. Journ." Oct. 27, 1877.

[2] Frazer: "Edin. Monthly Journ." Jan. 1848.

[3] "Opera Omnia; Centuria Prima." 1682, obs. 46, p. 41.

[4] Lib. ii. Obs. xv.

[5] "Selected Memoirs of the Royal Academy of Surg. of France." London, 1848, translated by Drewry Ottley.

[6] Cline: "Med. Gazette," vol. xxii. p. 38.

sweats break out on the body, and if immediate relief cannot be afforded death quickly takes place. Sometimes the dyspnœa is comparatively slight at the moment of the accident, but in the course of a few hours a sudden attack of suffocation comes on from change of position or from spasm of the glottis. This may cause immediate death, or it may pass off to be again repeated, perhaps with a fatal result. If, on the other hand, the offending substance be small and smooth, it may pass down the trachea and give rise to inflammation of the lungs without its ever being known that any accident has occurred,[1] or it may even remain in some part of the air passages without ever giving rise to any serious symptoms. Thus, Royer-Collard[2] has reported the case of a lunatic, who, in eating, unconsciously drew a piece of bone into his trachea, which remained in the respiratory canal for six years without causing any inconvenience. The bone was found in the left bronchus after death, and had given rise to no structural changes. As a rule, however, if a foreign body of moderate dimensions passes into the trachea it quickly causes irritation, and is usually followed by inflammation, with the customary symptoms of acute tracheal stenosis. Much, however, depends on the form of the foreign body. As a rule, if it is smooth and round, it only gives rise to slight irritation; whilst, if angular, its presence is quickly resented.

When the dyspnœa is at first very severe but soon passes off without the foreign body having been extruded, it may be inferred[3] that the offending substance was originally impacted in the larynx, but subsequently passed down the trachea. And even if the foreign substance at once passes into the trachea, the gravity of the symptoms depends to a great extent on the exact situation at which it becomes impacted; the dyspnœa, of course, is not nearly so urgent when the orifice of only one of the bronchi is blocked up, as when the canal of the trachea itself is considerably obstructed. The part of the air passage in which the foreign body becomes fixed has been already stated (page 413) as regards 166 of Bourdillat's cases, and it need only be remarked here that the position of the bronchial spur—somewhat to the left of the median line (see "Tracheoscopy")—causes foreign bodies to pass rather more readily into the right bronchus than the left, the proportion

[1] Renaldine: "Amer. Journ. of Med. Sci." i. p. 231.

[2] "Nouvelle Bibliothèque Médicale." 1826, t. i. pp. 196, 200, seq.

[3] See an illustrative case by Monckton: "Brit. Med. Journ." 1862, vol. i. p. 437.

being about as 5 to 3. Sometimes on coughing or expiring vigorously the foreign body can be felt externally by the surgeon's fingers moving up and down in the trachea, and two excellent illustrations of this phenomenon have been recorded by Mr. Couper.[1] More frequently, though the movement cannot be recognized by the surgeon, it can be felt by the patient. Occasionally the foreign body has been known to be forced up from one bronchus into the trachea and ultimately to pass into the opposite lung. These movements of the foreign body are sometimes followed by expulsion; sometimes by its impaction in a more dangerous situation.

In some cases foreign substances, which when first swallowed appeared to be comparatively innocuous, become dangerous from swelling, or from forming the nuclei of concretions. Beans not only swell, but even sprout, and a grain of corn has also been known to commence germinating.[2] Velpeau[3] records a case in which a bean swelled to treble its size in a few days, and Sheppard[4] relates another in which a piece of ginger became softened and swollen. A foreign body in the trachea often gives rise to flapping or whistling sounds, and if it blocks up one bronchus more than the other, the lung on the obstructed side will generally afford evidence of the condition on auscultation, there being diminished fremitus and absence of respiratory murmur on the affected side. This, however, is not an invariable rule, for in the case of Brunel,[5] though pain was felt in a situation corresponding to the lower portion of the right bronchial tube, and an examination with a probe (after tracheotomy) proved that the foreign body—a half-sovereign—was not in the trachea, *no difference between the two sides of the chest could be detected with the stethoscope.* Probably in this case the coin was immovably fixed with its edge at right angles to the long axis of the bronchus, resting, perhaps, against one of the walls of the tube. With the laryngoscope the foreign substance may sometimes be seen; on different occasions I have had the opportunity of observing in the windpipe a plum stone, a small piece of jet, and a button.

[1] "Brit. Med. Journ." vol. i. p. 153, Feb. 12, 1870.

[2] Gross: Op. cit. p. 39 (several other examples are given by this author); see also "Pacific Med. Journal," June, 1871.

[3] Ibid.

[4] "Lancet," 1845.

[5] "Trans. of Med.-Chir. Soc." vol. xxvi. p. 286. For further particulars of the case see page 570.

It has already been pointed out that foreign bodies sometimes pass through the air passages and become lodged in the tissue of the lungs, a result especially likely to occur in the case of bearded grain.[1] Under such circumstances they may give rise to serious inflammation, or even gangrene, or abscess,[2] and in fortunate cases the foreign body may be ultimately evacuated through the lateral walls of the thorax. Occasionally it would appear that the development of tubercle[3] may follow, just as when foreign substances have been experimentally introduced into the air passages of guinea-pigs.

*Diagnosis.*—As a rule, the history of the case is known, and the only question to determine is the site at which the foreign body is lodged. Occasionally, however, it is impossible to elicit any information as to the antecedents of the case. Thus, in children,[4] the circumstance that a foreign body has passed into the air passages may be unknown; whilst in adults the suffocation may be so imminent that the patient may not be able to describe what has happened, or, again, the accident may happen to an intoxicated person. If the laryngoscope can be used, a foreign body may, as already remarked, be seen in the trachea; whilst sometimes although the offending substance cannot be actually perceived in the windpipe, yet the laryngoscopic examination may afford valuable negative evidence by showing that it is not in the larynx. Where the foreign substance passes down one of the bronchi, the dyspnœa is not generally so severe as when it remains in the trachea, and the symptoms do not usually become very pronounced until some inflammation has been set up. The absence or diminution of the respiratory murmur over one lung indicates either that the foreign body is located in the corresponding bronchial tube, or else that it is situated

[1] Two cases are recorded by Sir Thomas Watson: "Prin. and Prac. of Physic," Fourth edition, vol. ii. p. 259. Other cases have been reported by Gross: Op. cit. p. 36; and Johnson: "Lancet," 1878, vol. ii. pp. 824 and 867.

[2] See a case reported by Gross: Op. cit. p. 247, and the case by Johnson referred to in Note 2.

[3] See two cases cited by Gross: Op. cit. p. 66; and a third by Royer-Collard: "Nouv. Bibliothèque Méd." t. i. 1826.

[4] Porter ("Path. of Lar. and Windpipe," 1837, p. 193) reports a remarkable case in which a little girl was knocked down and run over by a jaunting car, the wheel of which passed over her chest. The breathing became embarrassed and croupy, and the child died thirty-eight hours later. After death, the larynx was found to contain an almond shell, which was no doubt in her mouth at the time of the accident. There was no injury to the thoracic organs.

at the lower part of the trachea in such a way that it more or less completely covers the bronchial orifice.

*Prognosis.*—The prognosis must always be serious as long as the foreign body remains in the air passages, the gravity of the case depending on the nature of the foreign body, the amount of dyspnœa, or the intensity of the disease which has been set up. Mr. Erichsen[1] has pointed out that after the immediate danger has passed away, the greatest risk occurs between the second day and the end of the first month; that during the next month the mortality diminishes, but that later on it again increases. If the foreign substance is ejected after it has remained in the air passages only for a few days, rapid recovery generally takes place, and the same result may follow its expulsion even after months[2] or years.[3] In the latter case, however, recovery is not invariable, for the patient may die from the organic disease which has been set up.[4] In the case of children it must not be forgotten that the expulsion of a foreign body does not necessarily imply that the air passages are free from obstruction, for a number of cases are on record in which the ejection of one foreign substance, immediately on the performance of tracheotomy, has been subsequently followed by the expulsion of other bodies a few days or weeks later. This results from the child having drawn into its windpipe several substances either in succession, or at the same time.[5] The foreign substance sometimes becomes encapsulated, and the case in which a foreign body remained in the air passages for sixty years may be adduced to encourage patients when extraction cannot be effected.

In this case, a boy,[6] aged three years, received into his air passages a piece of bone, which was expelled sixty years later in a fit of coughing. The patient suffered at irregular intervals from hæmoptysis, purulent expectoration, and for a long time from cough and dyspnœa; but from the age of twenty-eight to forty-eight he was well enough to do a little work. The bone which was ultimately expectorated was "three-fourths of an inch in length, one-fourth in breadth, and one-twelfth in thickness, of an oblong triangular shape, smooth and convex on one side and rough on the other." It was probably much larger when it originally passed down the air passage.

[1] "The Science and Art of Surgery," Seventh edition, vol. i. p. 611.
[2] Howship: "Pract. Obs." Lond. 1816.
[3] Halmar: "Lond. Med. Journ." vol. viii.
[4] Gross: Op. cit. p. 176, gives eight cases illustrating this point.
[5] Ibid., p. 37, et seq.
[6] Gross: Op. cit. p. 172.

*Treatment.*—The first object of the practitioner should be, if possible, to remove the foreign body, and if the symptoms are at all severe, tracheotomy should be immediately performed. Directly the windpipe is opened, the sides of the wound should be held back by retractors, when the foreign body will often be coughed out through the tracheal opening or the mouth. If the operator has an assistant to help him, he can make use of the ordinary retractors, but otherwise self-acting elastic retractors (see page 515) should be employed. If the offending substance is not at once expelled it should, if possible, be seized with forceps. Professor Gross has invented a special forceps for this purpose, constructed on the ordinary principles of such instruments, that is to say, consisting of two blades with handles, the shanks of which are riveted together. Professor Gross's forceps are made of soft silver, and are of very slender dimensions, but for efficiency they are not to be compared to those forceps which are closed by means of a tube passing over their shoulders. My tube-forceps (see Fig. 46) are recommended by Durham[1] for this purpose, and will be found to answer well. The longest blades are $3\frac{1}{2}$ inches below the angle, but for exploring the right and left bronchi, this portion of the instrument should be at least five inches in length. Mr. Gant[2] has well pointed out that if the foreign body is loose in the trachea, chloroform should not be administered, but that if it is impacted the administration of a general anæsthetic will facilitate extraction with forceps. If the foreign body cannot be found, the edges of the tracheal wound should be stitched to the tissues at the side of the neck on each side, and for obvious reasons a canula should not be inserted. If the symptoms are not severe, a careful tracheoscopic examination should be made, as the mirror will sometimes enable the practitioner not only to see the foreign body, but to remove it.

A very remarkable case, showing the value of tracheoscopy, has recently been reported by Professor Voltolini.[3] A threaded needle, held by a man in his mouth, was, in laughing, suddenly drawn into the windpipe. The needle was seen with its point in the anterior wall of the trachea, just above the bifurcation, whilst the thread, fortunately double, extended upwards, and a loop of it was loosely thrown over the arytenoid cartilages. Voltolini, by seizing the thread with forceps, succeeded in raising the needle to a position

[1] "Holmes' System of Surgery," vol. ii. p. 491.
[2] "The Science and Practice of Surgery," 2nd ed. vol. ii. p. 354.
[3] "Monatsschrift für Ohrenheilkunde," Jahrgang xii. Nro. 12.

just below the vocal cords, whence it was quickly coughed up by the patient. The needle measured 3·3 centimetres, and the thread was 9 centimetres in length.

Inversion, or placing the patient head downwards, is a plan of treatment which probably suggested itself in the infancy of surgery, and, as Gross observes, "has probably been practised from time immemorial." It is a curious fact that the first recorded illustration of the operation is due to the greatest English architect, and that the most celebrated example of its success is the case of one of the greatest English engineers. On January 10, 1678, Sir Christopher Wren reported to the Royal Society a case of a man who, "swallowing a bullet down into his lungs, had been freed from the same long after by a person, who turned him with his heels upwards, and shook him, and thereby making him cough, occasioned the bullet to fall back into his epiglottis (*sic*), and from thence by the cough to be thrown out with great violence, and who had no further mischief thereby."[1] But the wide recognition which this method of treatment has obtained in this country is due to the great public interest which was excited in the case of Brunel,[2] who, in 1843, whilst amusing some children, let a half-sovereign slip into his windpipe. Tried before the trachea was opened, inversion gave rise to threatenings of suffocation, but after tracheotomy, the method was successful in the first trial.

If tracheotomy has been performed, inversion can always be carried out with safety, but even without this precaution it should be tried when the dyspnœa is not urgent in the case of coins and similar bodies whose weight and shape would favour their escape through the glottis. In carrying it out, the operator must be prepared to perform tracheotomy immediately if the foreign body, through change of position or by causing spasm of the glottis, should give rise to serious dyspnœa. Dr. Padley,[3] of Swansea, has described an excellent method by which the inversion can be effected; and he has well pointed out that when this method is adopted, the supine position favours the exit of the foreign body through the broad end of the triangular glottis being below. Dr. Padley's plan is as follows:—A strong bench having been fixed, with the legs of one end on a couch and the others on the floor, the patient is made to sit on the upper part of it,

[1] Birch: "Hist. Roy. Soc." vol. iii. p. 381.
[2] Loc. cit.
[3] "Lancet," vol. ii. 1878, p. 539.

with his knees fixed over the end. He is then directed to lie back upon the inclined plane. Not only does the supine position, as already remarked, favour the exit of the coin, but it enables the patient by his own effort to regain the upright position by using his knees as a fulcrum, and thus diminishes the danger if spasm supervenes. Dr. George Johnson[1] suggests that when a patient is inverted with the view of shaking out a foreign body, he should be directed to inspire deeply, in order to open the glottis as widely as possible; whilst, on the other hand, he must be strictly enjoined not to speak, as the vocal cords being brought together by such an act, the exit of the foreign body would be prevented.

## MALFORMATIONS OF THE TRACHEA.

*Latin Eq.*—Deformitates ingenitæ tracheæ.
*French Eq.*—Vices de conformation de la trachée.
*German Eq.*—Missbildungen der Trachea.
*Italian Eq.*—Vizi di conformazione della trachea.

DEFINITION.—*Congenital deviation from the normal formation of the trachea, occurring in monsters, and the non-viable fœtus, consisting in absence, obliteration, and doubling of the tube.*[2]

Those malformations which consist in the deficiency of some of the tracheal cartilages, or in the coalescence of several together, are of such little importance that they do not require any special notice, while most of the other irregularities are of such a nature that life is incompatible with them. In anencephalous monsters the trachea is occasionally absent. Meckel[3] has collected from the writings of Blanchot, Gilibert, and Klein, three such cases, and Albers has added a fourth, reported by Prochaska. Albers also mentions the case of a double-headed monster with one trunk, in which the trachea was double in its upper part and single lower down. Meckel also reports a

[1] "Lancet," vol. ii. 1878, p. 539.

[2] Malformations in which there is a communication between the trachea and gullet will be treated in the section devoted to the "Œsophagus," and those in which there is a fistulous opening externally will be considered under "Diseases of the Neck."

[3] "For this reference and others which are not given, see the article on "Malformation of the Larynx," page 496.

case by Otto, in which the trachea was completely obliterated; while in a case placed on record by Mondière,[1] a similar condition was associated with absence of the pharynx and œsophagus. Colby[2] gives an example in which there was no other malformation than an absence of the trachea, the rima glottidis leading into a small sac not half an inch in length; and lastly, Rossi has related an example of malformation in which the bronchi, at their origin, were incompletely blocked up by a cartilaginous diaphragm.

[1] "Arch. Gén. de Méd." Août et Sept. 1833.
[2] "Med. Times and Gaz." 1862, vol. ii. p. 236.

# APPENDIX.

## SPECIAL FORMULÆ FOR TOPICAL REMEDIES,

MOST OF WHICH ARE CONTAINED IN THE THROAT HOSPITAL PHARMACOPŒIA.

**Those Formulæ which are printed in black (Egyptian) type have been found of especial use by the author.**

### STEAM INHALATIONS.

STEAM inhalations are probably more useful than any other class of local remedies that can be employed by the patient himself. They are of the greatest service in all acute inflammatory affections of the throat, and also in most chronic affections of that organ. They can be employed with any of the inhalers already described (pages 248 and 249), or with those of a similar character, and should, as a rule, be used at a temperature of 140°, rarely over 150°, never over 160°. Under 130° they are of little use, unless ammonia is used. The inhalations which the author employs, and which he has introduced into the Throat Hospital Pharmacopœia, are mostly made with volatile oils, the oil being held in suspension in water by means of light carbonate of magnesia, in the proportion of half a grain of magnesia to a minim of oil. It has been found convenient to have the inhalation mixtures reduced to a uniform standard of one ounce, a teaspoonful of which constitutes the ordinary dose. The following is a specimen formula:—

℞. Ol. Pini Sylvest., ♏ xl.
Magnes. Carb., gr. xx.
Aquæ, ℥j.

A teaspoonful in a pint of water at 140°. To be inhaled for five minutes night and morning. (Six inspirations should be taken in a minute.)

*Stimulants.*

(Strong.)

Vapor Ammoniæ (Liquor. Ammon., sp. gr. .959, et Aquæ, part. æquales).
,, **Calami Aromatici (Ol. ℥v., ad ʒj.).**
,, Chlori. (Vap. Chlor., P.B.).
,, Iodi. (Tr. Iod. Co. ℥x., repeated twice or thrice during each inhalation).

(Medium.)

,, **Acidi Carbolici (gr. xx., ad Aquæ Callid. Oj.).**
,, Acidi Sulphurosi (P.B.).
,, Cajuputi (Ol. ℥viij., ad ʒj.).
,, Camphoræ (Sp. Camph. ʒj., Sp. Rect. ʒiij., Aquam ad ʒj.).
,, Cassiæ (Ol. ℥vj., ad ʒj.).
,, Cinnamomi (Ol. ℥vj., ad ʒj.).
,, **Creasoti (℥xl., ad ʒj.).**
,, **Cubebæ (Ol. ℥xl., ad ʒj.).**
,, Origani (℥v., ad ʒj.).
,, **Salviæ (℥x., ad ʒj.)**
,, Thymolis (gr. vj., Sp. Rect. ʒj., Mag. Carb. Lev. gr. iij., Aquam ad ʒj.).

(Mild.)

,, **Cubebæ c. Limone (Ol. Cubeb. ℥xxx., Ol. Limon. ℥x., ad ʒj.).**
,, **Juniperi Anglici (℥xx., ad ʒj.).**
,, **Myrti (℥vj., ad ʒj.).**
,, **Pini Sylvest. (Ol. ℥xl., ad ʒj.).**

*Sedatives.*

,, Ætheris (Æther, Sp. Rect., part. æqual.).
,, ,, Acetici (Acet. Æther, Sp. Rect., part. æqual.).
,, **Aldehydi (℥lxxx., ad ʒj.).**
,, **Benzoini (Tr. Benzoin. Co.).**
,, Chloroformi (Chloroform., Sp. Rect., part. æqual.).
,, Conii (Succus Conii ʒij., Sodæ Carb. Exsiccatæ gr. xx., Aquam Callidam ad ʒxx.).
,, Lupuli (Lupulin ʒss.).
,, Santali (Ol. ℥vj., ad ʒj.).

*Antispasmodics.*

Vapor Acidi Hydrocyanici (ʒj., ad ℥j.).
„ Ætheris (Æther., Sp. Rect., part. æqual.).
„ Amyl Nitritis (♏viij., ad ℥j.).

*Antiseptics.*

„ Acidi Carbolici (*see* Stimulants).
„ Chlori (P.B.).
„ Creasoti, Juniperi, Thymolis } (*see* Stimulants).

---

## SPRAY INHALATIONS.

Spray inhalations are especially indicated in cases of relaxation of the mucous membrane of the pharynx and air passages. The lactic acid and lime water sprays are useful in diphtheria, and the strong astringents are often of service in hæmoptysis. As a rule, spray inhalations are contra-indicated when there is dyspnœa.

*Astringents.*

**Vapor Acidi Tannici (gr. iij., ad ℥j.).**
„ Aluminii Chloridi (Liquor, Throat Hosp. Pharm., ♏iij., ad ℥j.).
„ Aluminis (gr. viij., ad ℥j.).
„ Ferro-Aluminis (gr. iij., ad ℥j.).
„ **Ferri Perchloridi (gr. iij., ad ℥j.).**
„ Ferri Sulphatis (gr. ij., ad ℥j.).
„ Potass. Chloratis (gr. xx., ad ℥j.).
„ **Zinci Chloridi (gr. ij., ad ℥j.).**
„ Zinci Sulphatis (gr. ij., ad ℥j.).

*Sedative.*

„ Acid. Hydrocyanici (ʒj., ad ℥j.).
„ Aquæ Lauro-cerasi (P.B.).
„ Potass. Bromid. (gr. xx., ad ℥j.).

*Hæmostatics.*

„ **Acidi Tannici (gr. x., ad. ℥j.).**
„ Ferri Perchlor. (gr. v., ad ℥j.).

*Antiseptics.*

Vapor Aluminii Chloridi (Liquor, Throat Hosp. Pharm., ♏ iij., ad ℥j.).
,, **Acidi Carbolici (gr. iij., ad ℥j.).**
,, **Acidi Lactici Medicinalis (♏ xx., ad ℥j.).**
,, **Calcis (Lime Water, P.B.).**
,, Potassæ Permanganatis (gr. v., ad ℥j.).
,, Potass. Chloratis (gr. xx., ad ℥j.).
,, Sodii Chloridi (gr. v., ad ℥j.).

## FUMING INHALATIONS.

Fuming inhalations are specially indicated in cases of spasm of the larynx, trachea, and bronchial tubes. They can best be carried out by steeping unsized paper in a solution of nitrate of potash of definite strength, cutting the paper into strips of three inches long by half an inch broad, lighting the paper and dropping it into a cylindrical vessel from which smoke can be inhaled. It will be found convenient to have three solutions—(No. 1) 30 grains to the ounce; (No. 2) 45 grains to the ounce; and (No. 3) 60 grains to the ounce. A particular character may be given to these papers by the addition of various volatile principles. Thus, camphor and cassia increase their powers, whilst benzoin, sandal, and sumbul reduce their action and make them less irritating. The medium strength paper (No. 2) is generally employed in these cases, and the best method of preparing it is to moisten the paper in a tincture, or, in the case of essential oils, in a solution of the oil (1 drachm dissolved in 9 drachms of rectified spirit), and then to expose it for a few minutes in order to allow the spirit to pass off.

These papers should be kept in tinfoil, or prepared in small quantities as required.

The following are the preparations found most useful :—

No. 2 Nitrated Papers, with Compound Tincture of Benzoin.
,, ,, Spirit of Camphor.
,, ,, Oil of Cassia.
,, ,, Oil of Cinnamon.
,, ,, Oil of Sandal.
,, ,, Tincture of Sumbul.

## GARGLES.

The use of gargles is too well known to require any explanation, but the author has never found them of service in diseases situated behind the anterior pillars of the fauces. Their employment is especially indicated in chronic affections, the tension necessary for the execution of gargling being often injurious in cases of acute inflammation.

*Stimulants.*

Gargarisma Acidi Acetici (Acid. Acet. Dil. ♏xv., Glycerini ♏xviij., Aquæ ℥j.).
,, Acidi Carbolici (*see* Antiseptics).
,, Acidi Hydrochlorici (Acid. Hydrochl. Dil. ♏xij., Glycerini ♏xxiv., Aquæ ℥j.).

*Astringents.*

,, **Acid. Tan. Com. (Acid. Tannic. gr. xij., Sp. Rect. ♏vj., Mist. Camph. ℥j.).**
,, Acid. Tan. et Gall. (Acid. Tan. gr. cccl×., Acid. Gallic. gr. cxx., Aquæ ℥j.).
,, Aluminii Chloridi (Liquor, Throat Hosp. Pharm., ♏xij., ad ℥j.).
,, **Aluminis (gr. viij., ad ℥j.).**
,, ,, c̄ Acid. Tannic. (Alum. gr. vj., Acid. Tannic. gr. viij., Aquæ ℥j.).
,, Boracis (Boracis gr. xxiv., Glycerini ♏xxiv., Tr. Myrrhæ gr. xxiv., Aquæ ℥j.).
,, Ferro-Aluminis (gr. viij. ad ℥j.).
,, Hydrarg. Perchlor. (Hydrarg. Perchlor. gr. ¼, Glycerini ♏xxiv., Aquam ad ℥j.).
,, **Krameriæ (Infusion. ℥ss., ad Aquæ Callidæ Oj.).**

*Sedative.*

,, Potassii Bromidi (gr. x., ad ℥j.).

*Antiseptics.*

,, Acidi Acetici (Acid. Acet. Dil. ♏xv., Glycerini ♏xviij., Aquæ ℥j.).
,, Acidi Carbolici (Acid. Carbolic. gr. ij., Glycerini ♏xxiv., Aquæ ℥j.).
,, **Potassæ Chloratis (gr. xij., ad ℥j.).**
,, **Potassæ Permang. (Liquor, P.B., ♏vj., ad ℥ij.).**
,, Sodæ Chloratæ (Liquor, xxiv., ad ℥j.).

## LOZENGES.

The lozenges in the Throat Hospital Pharmacopœia are, with the exception of carbolic acid and marsh mallow, all made with "fruit paste" (a well-known article of commerce with which lozenge manufacturers are quite conversant), tragacanth, and a small quantity of refined sugar.

The following is a specimen of the composition of these lozenges, Rhatany being taken as an example:—

℞—Extract of Rhatany, in powder, grs. 1050.
Tragacanth ,, ,, 70.
Refined Sugar ,, ,, 280.
Red Currant Paste as much as is sufficient.

Mix the dry ingredients, then add the red currant paste until the whole mass weighs 1 lb.; divide into 350 lozenges of 20 grains each, and dry them in a hot-air chamber. Each lozenge contains 3 grains of extract of rhatany.

*Dose*—1 lozenge every 3 or 4 hours.

*Stimulant.*

**Trochiscus Acidi Benzoici (gr. ss., ad troch.).**
,, Acidi Carbolici (gr. j., ad troch.).
,, **Cubebæ (gr. ss., ad troch.).**
,, **Guaiaci (gr. ij., ad troch.).**
,, Potassæ Chloratis (gr. iij., ad troch.).

*Astringent.*

,, Acidi Tannici (gr. iss., ad troch.).
,, Catechu (gr. ij., ad troch.).
,, **Kino (gr. ij., ad troch.).**
,, **Krameriæ (gr. iij., ad troch.).**

*Sialagogue.*

,, Potass. Tart. Acid. (gr. iij., ad troch.).
,, Potassæ Cit. (gr. iij., ad troch.).
,, **Pyrethri (gr. j., ad troch.).**

*Sedative.*

,, Ammonii Chloridi (gr. ij., ad troch.).
,, Boracis (gr. iij., ad troch.).
,, Lactucæ (gr. j., ad troch.).
,, Sedativ. (Ext. Opii gr. $\frac{1}{10}$, ad troch.).

*Emollient.*

,, Althææ (*Pastillæ Guimauve*).

*Antiseptic.*

Trochiscus Acidi Carbolici (gr. j., ad troch.).
,, **Potassæ Chloratis (gr. iij., ad troch.).**

## PIGMENTS.

The use of pigments is especially indicated in chronic and mild sub-acute affections of the pharynx and larynx; in cases of acute inflammation, on the other hand, they almost always do harm. Their special advantage consists in it being possible to apply them exactly to the diseased surface, and to limit their action to that spot.

*Stimulant.*

Pigmentum Argenti Nitratis (gr. xxx., ad ℥j.).
,, **Cupri Sulphatis (gr. xx., ad ʒj.).**
,, Ferri Perchlor. Fort. (℥ij., ad ℥j.).

*Astringent.*

,, **Aluminii Chloridi (Liquor, Throat Hosp. Pharm., ♏xv., ad ʒj.).**
,, **Zinci Chloridi Dil. (gr. xv., ad ʒj.).**
,, Zinci Sulphatis (gr. lx., ad ℥j.).
,, Acidi Tannici (Glycerini, P.B.).
,, Ferro-Aluminis (gr. lx., ad ℥j.).
,, **Ferri Perchlor. Dil. (ʒj., ad ʒj.).**
,, Ferri Sulphatis (gr. lx., ad ℥j.).

*Sedative.*

,, Boracis (Glycerini, P.B.).
,, Amyli (Glycerini, P.B.).

*Antiseptic.*

,, Acidi Carbolici (gr. xxx., ad ℥j.).
,, **Aluminii Chloridi (♏xv., ad ʒj.).**
,, Acidi Carbolici (Glycerini, P.B.).
,, **Tolu (Balsam. Tolutan. gr. lxxx., Æther. ad ʒj.).**

## INSUFFLATIONS.

Insufflations are of great use in all acute and painful affections of the pharynx, larynx, and trachea. In laryngeal phthisis morphia insufflations greatly prolong the life of the patient and save him much suffering. In tracheal affections insufflations are the most valuable class of remedies that can be employed. Where the medicament consists only of a small quantity of a fine powder, as in the case of morphia, it is convenient to give bulk to it by the use of half a grain of starch, gum, or sugar of milk; the starch, however, in my experience answers best.

Insufflatio Acidi Tannici (gr. ij.).
„ **Aluminis (gr. ij.).**
„ Ammonii Chloridi (gr. ij.).
„ **Bismuthi Carb. (gr. ij.).**
„ Boracis (gr. iij ).
„ **Iodoform. (gr. j.).**
„ **Morphiæ (gr.** $\frac{1}{16}$, $\frac{1}{8}$, $\frac{1}{4}$, $\frac{1}{2}$).
„ Plumbi Acetatis (gr. j.).

---

## NUTRITIVE ENEMA.

As a considerable number of patients suffering from throat diseases are unable to swallow, it is of the greatest importance, in treating these affections, that the best means of introducing nourishment into the system *per rectum* should be at the command of the practitioner. The formula given below is a slight modification of that published by Leube[1] in 1871. I commenced experiments with nutritive enemata in January, 1872, and in 1874 arrived at the conclusion that the following was the best formula; since then I have constantly used it.[2]

| | | | | | |
|---|---|---|---|---|---|
| Cooked beef, mutton, or chicken, | | | | 3 ounces | 7 drachms. |
| Sweetbread | ... | ... | ... | 1 ounce | 7 drachms. |
| Fat | ... | ... | ... | ... | 6 drachms. |
| Brandy | ... | ... | ... | ... | 2 drachms. |
| Water | ... | ... | ... | ... | 3 ounces. |

[1] "Deutsches Archiv f. Klin. Medicin." No. xx. 1871.

[2] The ordinary elastic bottle enema, with a tube half an inch in bore, answers the purpose very well. It is supplied by Messrs. Mayer & Meltzer, instrument makers to the Throat Hospital.

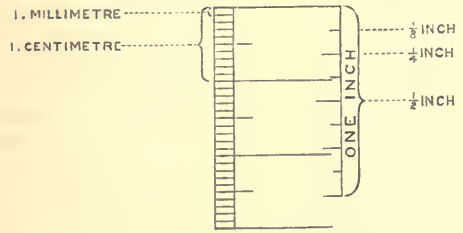
These ingredients, mixed together, will measure 9 ounces. The meat, sweetbread, and fat must be first passed through a fine mincing machine and then be rubbed up, with the water gradually added, to make a very thick paste. The enema should be given at a temperature of 90° to 95°, and *ought not to be administered more than twice in twenty-four hours*. The rectum should be washed out twice or three times a week with tepid water, three or four hours before giving the nutritive injection.

## METRIC MEASUREMENTS

COMPARED WITH

## THE ENGLISH INCH.

THE subdivisions of the metre having been used in this book, as well as the fractions of an inch, I have thought it convenient to place the two scales in comparison.




A millimetre is the $\frac{1}{1000}$th part of a metre.

A centimetre is the $\frac{1}{100}$th part of a metre.

**A metre = 1 yard $3\frac{3}{8}$ inches** (or more exactly $39\frac{37}{100}$ inches).

**A centimetre** = rather more than $\frac{3}{8}$**ths of an inch** (or more exactly $\frac{39}{100}$ths of an inch.[1])

**$2\frac{1}{2}$ centimetres** = not quite **1 inch** (or not quite $\frac{39}{40}$ths of an inch[2]).

[1] The precise fraction is $\frac{3937}{10000}$.

[2] The precise fraction is $\frac{3937}{4000}$.

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